NUCLEAR SCIENCE ABSTRACTS

Volume 11 October 15, 1957 No. 19

GENERAL

ATOMIC POWER

10387
THE PROSPECTS OF NUCLEAR POWER AND TECHNOLOGY. Gerald Wendt. Princeton, D. van Nostrand Company, Inc., 1957. 358p.

The status of atomic power and the technological factors involved are presented in this volume. (W.L.H.)

10388
RUSSIA'S A-POWER PROGRAM MUCH LIKE AMERICAN, BELGRADE REPORT REVEALS; FIRST BIG STATION LIKE PWR. Nucleonics 15, No. 7, 20-2(1957) July.

Two Russian papers were presented at the eleventh sectional meeting of the World Power Conference in Belgrade. One was entitled "Outlook for Utilization in the USSR of Nuclear Fuel for Power Purposes," and the other was called "Project for a 420-Mw Atomic Electric Station." The two papers are analyzed for information on Russia's present power reactor development program. On the basis of information presented, it appears that the program is patterned remarkably closely after that of the U. S. Four small reactors include a boiling water, a sodium-graphite, a heavy-water homogeneous using thorium, and a fast plutonium breeder. Two large-scale nuclear stations include one using pressurized water for both moderation and cooling, which follows a design much like a scaled-up Shippingport, and a water-cooled and graphite moderated reactor like Russia's first 5-Mw prototype power reactor. (C.H.)

10389
NUCLEAR NAVY PACES U. S. ATOMIC INDUSTRY. John E. Kenton. Nucleonics 15, No. 7, 66-71, 126(1957) July.

Plans for the conversion of the U. S. combat fleet to nuclear propulsion are discussed. (C.H.)

RESEARCH PROGRAMS

10390
THERMONUCLEAR RESEARCH THE WORLD AROUND. REPORT ON THE VENICE CONFERENCE. L. Reiffel. (Armour Research Foundation, Chicago, Ill.). Nucleonics 15, No. 8, 88-9, 117(1957) Aug.

The status of unclassified research on controlled fusion is discussed from a world-wide point of view. So far no one seems to have achieved a genuine controlled thermonuclear reaction, but experimental and theoretical results are increasingly encouraging. (C.H.)

BIOLOGY AND MEDICINE

10391 UCRL-3810
California. Univ., Berkeley. Radiation Lab.
TISSUE-CULTURE GROWTH STIMULATION BY NUCLEIC ACID- AND LIPID-RICH SUBFRACTIONS OF THE EMBRYONIC NUCLEOPROTEIN FRACTION. Roman J. Kutsky, Frank Lindgren, and Alex V. Nichols. June 14, 1957. 11p. Contract W-7405-eng-48. $0.10(OTS).

10392 UR-498
Rochester, N. Y. Univ. Atomic Energy Project.
A METHOD FOR CONCENTRATING LEUKOCYTES. A. McKane and M. Ingram. June 3, 1957. 21p. Contract W-7401-eng-49. $0.25(OTS).

10393 AEC-tr-2872
SECOND ALL-UNION CONFERENCE ON PHOTOSYNTHESIS, JANUARY 21-26, 1957. Summaries of Papers. Translated from a publication of the Academy of Sciences, U. S. S. R., Div. of Biological Sciences and Soil Biology, Moscow University Press, 1957. 122p. $0.60(OTS).

Topics discussed at this conference include: the photochemistry and spectroscopy of chlorophyll and other plant pigments; the formation, state, and conversion of pigments in plants; the structure, biochemistry, and chemistry of chloroplasts; bacterial photosynthesis; carbon conversion paths and products of photosynthesis; photosynthesis as a physiological process and productivity factors; the cultivation of plants under artificial light; photosynthesis by algae and the productivity of various bodies of water; and methods for measuring and calculating the products of photosynthesis. Carbon^{14} was used as a tracer in a few of the studies reported. 128 references. (C.H.)

RADIATION EFFECTS

10394 AF-SAM-57-78 and AF-SAM-57-79
Washington. Univ., Seattle. School of Medicine.
THE COMBINED EFFECTS OF IONIZING RADIATION AND LOW TEMPERATURE ON THE METABOLISM, LONGEVITY AND SOFT TISSUES OF THE WHITE RAT. METABOLISM AND LONGEVITY. Report No. 57-58. L. D. Carlson, W. J. Scheyer, and B. H. Jackson. Dec. 18, 1956. 7p. HISTOLOGIC CHANGES. Report No. 57-59. P. C. Griffith, W. J. Scheyer, and S. W. Lippincott. Dec. 18, 1956. 8p.

Male Sprague-Dawley rats living at 25° and 5°C were exposed to total-body Co^{60} irradiation of 0.1 r/hr for 8 hr daily from 4 mo to 16 mo of age. The 5°C irradiated rats had a half-life of 305 days compared to 240 days for their controls. The 25°C irradiated rats had a half-life of 600 days compared to 460 days for their controls. At 25°C the oxygen consumption of the irradiated animals was higher than that of nonirradiated animals but the difference was not significant until the animals were 13 months old. (auth)

10395 AF-SAM-57-89
School of Aviation Medicine, Randolph AFB, Texas.
USING Co^{60} TO DETERMINE THE $LD_{50/30}$ FOR THE RAT. Robert E. Tatsch, John C. Tourville, and Loren C. Logie. Jan. 29, 1957. 3p.

When Co^{60} was used at a dose rate of 500 r/minute, an $LD_{50/30}$ of approximately 950 r was found for female Sprague-Dawley rats. Two methods of analysis were used to determine the $LD_{50/30}$. Results were compared with those of other experiments using 250 kvp x rays. (auth)

10396 AF-SAM-57-108
Brooklyn Coll., New York, and School of Aviation Medicine, Randolph AFB, Texas.
SERUM TRANSAMINASE CHANGES AFTER LOCAL IN-

JURY. Harry G. Albaum and Lawrence J. Milch. Mar. 20, 1957. 5p.

Small, but statistically significant, increases of serum glutamic oxaloacetic transaminase (G-O-T) are shown to be associated with local irradiation injury in the rabbit. Similar results are observed after crush injury. If the rabbit leg is subjected to 3 hr of tourniquet ischemia, however, G-O-T elevations of extent comparable to human myocardial infarction and acute hepatocellular damage are observed. (auth)

10397 UR-490
Rochester, N. Y. Univ. Atomic Energy Project.
THE EFFECT OF AIR SPACE ON SUB-FABRIC BURNS IN SWINE. K. M. Berkley. May 3, 1957. 30p. Contract W-7401-eng-49. $0.35(OTS).

The effect of separating white cotton sheeting from pig skin by an air space on the radiant exposures necessary to produce superficial radiant energy burns, judged by gross and microscopic appearance, was studied in 1200 burns at exposure times of 0.5, 1.0, 2.0, and 5.0 seconds. It was found that the radiant exposure increases linearly by the amount of separation measured in millimeters, and that this relationship is not dependent on the exposure time used. (auth)

10398 USNRDL-TR-141
Naval Radiological Defense Lab., San Francisco.
URINARY EXCRETION OF URIC ACID AND ALLANTOIN BY THE X-IRRADIATED-ADRENALECTOMIZED RAT. K. Jackson and C. Entenman. Jan. 30, 1957. 16p. Project NM 006-015.

10399 AEC-tr-2874
EARLY CHANGES IN THE BLOOD SERUM, RESULTING FROM X-RAY TREATMENT, AS SHOWN BY ULTRA-VIOLET SPECTROGRAPHY. B. M. Graevskaya and B. A. Orlov. Translated from Doklady Akad. Nauk S.S.S.R. 108, 623-5(1956). 4p.

10400
EFFECTS OF X RAYS ON THE NUCLEIN EXCHANGE IN LIVER. G. P. Torpova. Doklady Akad. Nauk S.S.S.R. 114, 80-3(1957) May 1. (In Russian)

Investigations were made of the number of nuclei in the tissue, the content of nucleoproteins and nucleic acids, and the changes in the chemical composition of nucleic acids released from the pure nuclei of liver tissues taken from rats killed in various stages of radiation sickness. (R.V.J.)

10401
EFFECTS OF IRRADIATION ON HEMATOPOIETIC ORGANS IN THE ANIMAL ORGANISM PROTECTED BY CARBON MONOXIDE. N. F. Barakina. Doklady Akad. Nauk S.S.S.R. 114, 285-8(1957) May 11. (In Russian)

10402
ON THE LACK OF PROTECTIVE EFFECTS OF HISTOTOXIC HYPOXY IN IONIZING RADIATION. E. J. Graevskiĭ and M. M. Konstantinova. (Severtsov Inst. of Animal Morphology). Doklady Akad. Nauk. S.S.S.R. 114, 289-92(1957) May 11. (In Russian)

10403
THE COURSE OF PREGNANCY AND LABOR IN ANIMALS EXPOSED TO TOTAL-BODY IRRADIATION IN SINGLE SUBLETHAL DOSES. N. A. Kalinina (Inst. of Obstetrics and Gynecology, Acad. of Med. Sciences U.S.S.R.). Med. Radiol. 2, 55-9(1957) May-June. (In Russian)

Irradiation of rats in early stages of pregnancy (9 to 12 days) was fatal to the fetus which, however, was retained by the uterus causing pathogenic irritation in pregnant animals. Irradiation in late stages of pregnancy retarded the delivery and complicated the labor, holding back the placenta. The rats born from irradiated mothers were lighter in weight and died after delivery. Babies born from irradiated rats but nursed by healthy rats lived longer. (R.V.J.)

10404
CONFERENCE ON THE PROBLEMS OF REMOTE EFFECTS OF IONIZING RADIATION. Z. M. Karelina. Med. Radiol. 2, 86-9(1957) May-June. (In Russian)

10405
EFFECTS OF IONIZING RADIATION OF THE DEVELOPMENT OF ORGANISMS. A. A. Neifakh (Severtsov Moscow Inst. of Animal Morphology). Priroda 46, No. 6, 19-28 (1957) June. (In Russian)

A review is given of radiation effects in radiobiology, genetics, and biochemistry. (R.V.J.)

10406
LOCAL RADIATION REACTION OF MEMBRANES AND EFFECTS OF CORTISONE TREATMENT (EXPERIMENTS ON GUINEA PIGS AND WHITE RATS). Max Pöschl. Strahlentherapie 103, 289-93(1957). (In German)

10407
THE SIGNIFICANCE OF BODY POSITION IN THE DEVELOPMENT OF BIOLOGICAL RADIATION EFFECT AFTER TOTAL-BODY IRRADIATION. Béla Wald, Vilmos Várterész, and László Boróky. Strahlentherapie 103, 294-7(1957). (In German)

10408
RADIOINDUCED DISTURBANCES IN THE DEVELOPING EMBRYO OF XIPHOPHORUS HELLERI. Rainer Penners. Strahlentherapie 103, 305-16(1957). (In German)

RADIATION HAZARDS AND PROTECTION

10409 ANL-5743
Argonne National Lab., Lemont, Ill.
GLOVES FOR PROTECTIVE ENCLOSURES. Final Report [On] Metallurgy Program 1.5.3. D. A. Davis, J. E. Ayer, and R. M. Mayfield. May 1957. 22p. Contract W-31-109-eng-38. $0.25(OTS).

A study of the glove problem has been made by the ANL Glove Committee as a necessary prerequisite to any attempt at coordination or standardization. This report consists of a compilation of the findings of the Committee and the resulting compromises which are felt necessary to the resolution of the problem. Materials, methods of manufacturing and general properties of gloves are described. Glove design has been analyzed and suggestions are made in regard to an acceptable standard. Permeability characteristics of various glove compounds are reviewed and the effect of moisture contamination upon hypothetical systems is tabulated. An electrical test is proposed for the determination of glove soundness. (auth)

10410 CF-57-7-31
Oak Ridge National Lab., Tenn.
THE ECONOMICS AND HAZARD POTENTIAL OF WASTE DISPOSAL. E. D. Arnold. July 8, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The two most important considerations in the disposal of radioactive wastes are safety and economy. All other steps in the waste disposal complex must be tuned to accomplish these two goals. In general, the hazardous waste in the nuclear power complex affect the cost of the nuclear power reactor fuel cycle, the general environment since disposal must exclude radioactivity from the environment for over 500 years, the costs and/or methods of waste treatment including fission product utilization, the methods of shipping, the location of chemical processing plants and waste disposal sites, the methods of disposal

best suited for a particular type of waste or site location, and potential public damage and third-party liability. (auth)

10411 HW-25457(Rev. 1)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MANUAL OF RADIATION PROTECTION STANDARDS. July 1957. 59p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

Hanford policies and procedures are reviewed relevant to the control of hazards during work with radiation and radioactive materials. (C.H.)

10412 UCLA-401

California. Univ., Los Angeles. Atomic Energy Project.

SUMMARY OF CERTAIN TRENDS IN SOIL-PLANT RELATIONSHIP STUDIES OF THE BIOLOGICAL AVAILABILITY OF FALL-OUT DEBRIS. H. Nishita and K. H. Larson. July 28, 1957. 68p. Contract AT-04-1-GEN-12. $0.40 (OTS).

A summary is presented of the data obtained from an investigation pertaining to radioactive fall-out and to soil and plant factors that may influence the accumulation of fission products in animals. The chemical and physical properties of fall-out originating from nuclear detonations are highly dependent upon the conditions of the detonation. Near surface bursts less than 300 feet studied at continental test sites yielded predominately siliceous particles suggesting incorporation of the soil while higher tower detonations reflect the incorporation of tower material. The median particle size of fall-out generally decreased with increasing distance. However, the abundance of particles less than 100 μ in diameter remained approximately the same or increased up to 160 miles from Ground Zero. The solubility of fall-out material ranged from zero to 6.5% in distilled water and from 2 to 74% in 0.1N HCl. The decay constant observed on actual fall-out particles ranged from −0.80 to −1.7 depending on the time up to 1,000 hr. Soil-plant experiments showed the influence of several soil and plant factors on the availability and accumulation if individual fission products in plants grown on agriculturally important soils. Of the fission products studied, radiostrontium was the most readily taken up by crop plants from contaminated soils while only very small amounts of Y^{91}, Ru^{106}, Cs^{137}, and Ce^{144} were accumulated. The amount of fission products accumulated varied with plant species, but in general, the greatest amounts of the fission products were accumulated in the leaves. Of the fission products accumulated in plants, significant percentages of the total were extractable with distilled water. Certain soil properties such as bicarbonate ion concentration, organic matter content, complementary ion concentration, and clay mineral type were shown to have considerable influence on the uptake of fission products by plants. The presence of high concentration of bicarbonate ions in nutrient media reduced the uptake of all isotopes (except Cs^{137}) studied. The addition of non-composted organic matter to soils reduced Sr^{90} uptake by plants. The addition of Ca fertilizers to soils reduced Sr^{90} uptake from acidic soils but had little or no influence on the uptake from neutral and alkaline soils. The uptake of Cs^{137} occurring as a contaminant increased as the K concentration in the soil was reduced by prolonged cropping. Fixation and extractability studies showed that the availability of fission products to plants was related to the nature of the soil exchange complex. In selected field study areas in the environs of the continental test sites, the fate and persistence of fission products originating from fall-out have been documented as they occur in the various components of the environment. In undisturbed areas, the radioactive residues were confined to the surface inch or two of the soil profile even after 10 years following fall-out contamination. The native animals collected in contaminated areas showed that fission products are metabolized and accumulated. Radioiodine and radiostrontium were accumulated in the thyroids and bones, respectively. The accumulation of these isotopes appeared to be a function of distance from Ground Zero. The accumulation of radioiodine in the thyroid was much greater at 60 miles from Ground Zero than at either 12 or 160 miles. Similar distance to accumulation relationship was observed with radiostrontium. The plant uptake of fission products originating from fall-out was a negligible fraction of the total contamination on or in the soil. Thus, the fission product contamination of plants in fall-out contaminated areas was found to be primarily external radioactive dust. The amount of fall-out particles retained by plant foliage was dependent upon its characteristics such as hairs, glands, stomata, and other mechanical traps. The major fraction of the particles retained on plant foliage was less than 44 microns in diameter. (auth)

10413

GENETIC FACTORS INFLUENCING IRRADIATION PROTECTION BY BONE MARROW. I. THE F_1 HYBRID EFFECT. Delta E. Uphoff (National Cancer Inst., Bethesda, Md.). J. Nat. Cancer Inst. 19, 123-30(1957) July.

10414

THE EFFICACY OF CERTAIN SUBSTANCES FOR DECONTAMINATION OF HANDS CONTAMINATED BY RADIUM SALTS. O. S. Andreeva. Med. Radiol 2, 59-61 (1957) May-June. (In Russian)

10415

ON MISCONCEPTIONS ABOUT SOME PROTECTIVE MEASURES FOR INDIVIDUAL PROTECTION OF PERSONNEL AGAINST γ RADIATION. S. M. Gorodinskii and E. A. Fishevskaya. Med. Radiol. 2, 83-4(1957) May-June. (In Russian)

10416

PROCEEDINGS OF THE HEALTH PHYSICS SOCIETY. FIRST ANNUAL MEETING JUNE 25-27, 1956. Ann Arbor, University of Michigan, 1956. $3.00.

Thirty-four complete papers and abstracts of six papers presented at this conference cover a random sampling of health physics activities. (C.H.)

RADIATION SICKNESS

10417

THE EFFICACY OF CYSTEINAMINE PREPARATIONS IN PROPHYLAXIS OF RADIATION SICKNESS IN CLINICAL CONDITIONS. A. I. Strashinin. (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 2, 52-4(1957) May-June. (In Russian)

RADIOTHERAPY

10418

COMBINATION THERAPY OF MALIGNANT TUMORS WITH IONIZING RADIATIONS AND CHEMICALS: A REVIEW. Harry N. Bane, John T. Conrad, and George S. Tarnowski (Sloan-Kettering Inst. for Cancer Research, New York). Cancer Research 17, 551-66(1957) July.

10419

BIOLOGICAL PROTECTION AGAINST RADIATION IN EXPERIMENTAL X-RAY THERAPY OF TUMORS. M. P. Domshlak, I. I. Ivanov, et al. Med. Radiol. 2, 47-52(1957) May-June. (In Russian)

10420

ALPHA THERAPY. E. S. Shchepot'eva. Med. Radiol. 2, 62-77(1957) May-June. (In Russian)

Effective applications of α therapy and the integral absorption of various doses of α radioactive isotopes in various procedures and methods of therapeutic treatment are evaluated. (R.V.J.)

10421
THERAPEUTIC USE OF RADIOISOTOPES; A CRITICAL SURVEY. Frank Ellis. Strahlentherapie 103, 176-93 (1957). (In German)

A review is presented of applications of various radioisotopes in telecurie beam therapy. Technical and economic details of various therapeutic applications of radioisotopes are discussed. (C.H.)

TOXICOLOGY STUDIES

10422
THE EXTREME SMALLNESS OF THE MAXIMUM PERMISSIBLE INTAKE OF RADIONUCLIDES MAKES PRESENT RADIATION DETECTORS USELESS. Pierre-Octave Robert. J. phys radium 18, Suppl., 103A-5A(1957) July. (In French)

The maximum permissible intake of the various radionuclides that present practical danger in the nuclear industries and correspond to an amount of 150 rem accepted for a life-span of 70 years varies from 1.4×10^{-3} mg to 1.21 mg. The present radiation detectors are not adapted to this specific problem. The use of masks providing a rigorous filtering of dusts is imperative. (auth)

TRACER APPLICATIONS

10423 UCRL-3806
California. Univ., Berkeley. Radiation Lab.
ESTIMATED RADIATION DOSAGE IN MAN FROM ADMINISTERED MORPHINE-N-METHYL-C^{14}. B. M. Tolbert. June 6, 1957. 7p. Contract W-7405-eng-48. $0.15(OTS).

Radiation dose to man from administered morphine-N-methyl-C^{14} is estimated using human C^{14} excretion data. Cumulative dosages are calculated assuming 100 μc injected compound and uniform distribution of activity. Kidney radiation dose is also estimated. (auth)

10424 UR-500
Rochester, N. Y. Univ. Atomic Energy Project.
THE METABOLISM OF INDIUM^{114m} ADMINISTERED TO THE RAT BY INTRATRACHEAL INTUBATION. Geneva A. Smith, Robert G. Thomas, Barbara Black, and James K. Scott. June 18, 1957. 46p. Contract W-7401-eng-49. $0.35(OTS).

10425
THE DISTRIBUTION OF RADIOTHALLIUM IN THE RAT. René Truhaut, Paul Blanquet, and Lucien Capot. Compt. rend. 245, 116-19(1957) July 1. (In French)

10426
THE EFFECT OF BRAIN CONDITION OF THE ABSORPTION OF RADIOACTIVE IODINE BY THYROID GLAND. B. V. Aleshin and N. S. Demidenko. (Ukraine, Inst. of Experimental Endocrinology). Med. Radiol. 2, 77-82(1957) May-June. (In Russian)

CHEMISTRY

10427 AERE-M/TN-12
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PREPARATION, PROPERTIES AND ALLOYING BEHAVIOUR OF THORIUM. J. R. Murray. June 25, 1952. Decl. May 9, 1957. 35p.

The methods of preparation, physical properties, and alloying behavior of thorium are reviewed, the information being drawn from the literature and from some unpublished results obtained at A.E.R.E. 105 references. (auth)

10428 ISC-834
Ames Lab., Ames Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JULY–DECEMBER 1956. Mar. 15, 1957. 44p. Contract W-7405-eng-82. $0.30(OTS).

Research is reported in preparation, separation, and properties of rare earths, some fused salt studies, Ag extraction of fission products from U, tracer study of Hg ions, exchange reactions, and x-ray chemistry. (For preceding period see ISC-757.) (T.R.H.)

10429 KLX-10043
Vitro Labs., West Orange, N. J.
THE PRODUCTION OF MICRO-DISPENSED ELEMENTAL BORON BY MEANS OF THE HIGH INTENSITY ARC. Period covered: March 26, 1954 to September 26, 1955. Vitro Job 2004. Charles Sheer, H. F. Reichard, R. G. Berner, J. A. Dyer, and S. Korman. Sept. 1956. 34p. Project 3055. Contract AF33(616)-2527. (WADC-TR-56-462; AD-118304).

The carbothermic reduction of boric oxide in the high-intensity arc flame has been explored as the basis of a practical technology for producing finely divided elemental boron. Using hollow-core graphite electrodes with the boric oxide cast into the central cavity, yields of submicron elemental boron up to 17% have been obtained in the crude arc effluent; the principal solid contaminants are boric oxide and boron carbide. The yield and purity are not sufficient to warrant translation of the process to a larger scale at the present time. Improvement in these respects might be obtained through the use of homogeneous (rather than cored) electrodes and through the development of more rapid means of quenching the arc tail-flame to prevent side reactions which use up the liberated boron. (auth)

10430 LA-1936
Los Alamos Scientific Lab., N. Mex.
THE PREPARATION OF HIGH-PURITY CALCIUM OXIDE. Robert N. Roberts. Oct. 1953. 41p. Contract W-7405-eng-36. $0.30(OTS).

A reliable method is described for the preparation of the high-purity CaO required as base matrix of the standards used in the spectrochemical analysis of either calcium metal or the oxide. The method consists of (1) the purification of aqueous calcium chloride solutions by modified standard procedures for chemical separations, (2) the subsequent precipitation of calcium oxalate, using carefully purified reagents, and (3) the ignition of the oxalate to the oxide under noncontaminating conditions. Double-distilled calcium metal containing less than 0.2 percent metallic impurities is a convenient starting material. The ignition of the calcium oxalate and the pulverization of the resulting oxide in preparing standards involved low-level impurity contamination which was mainly derived from the apparatus used. The identification and elimination of these sources of contamination by numerous painstaking tests constituted a major portion of the investigation and were essential to the development of the method. The contamination problems and the means taken to eliminate them are emphasized. By employing the recommended procedure, high-purity calcium oxide containing only about 100 parts per million of gold and one each of silver and copper as detectable impurities exceeding the 1-part-per-million level can be made consistently in 60-gram batches. (auth)

10431 NBS-4746
National Bureau of Standards, Washington, D. C.
REFERENCE ELECTRODES FOR MOLTEN SALTS.

Progress Report [for] April 1 to June 30, 1956. Vernon A. Lamb and Roger J. Labrie. July 1, 1956. 7p. NBS Project 0506-10-3280. $1.80(ph OTS); $1.80(mf OTS).

The development of a group of reference electrodes suitable for use in potential measurements in molten salts and the evaluation of the electrode potentials to form a mutually consistent reference group are presented. During the present period experiments were made with the following systems: $Pt/PtCl_4^{2-}$ electrode in LiCl–KCl–NaCl system and Na–Sn glass and Na glass electrodes. (W.L.H.)

10432 NBS-4881

National Bureau of Standards, Washington, D. C.
REFERENCE ELECTRODES FOR MOLTEN SALTS. Progress Report [for] July 1 to September 30, 1956. Vernon A. Lamb and Roger J. Labrie. Oct. 1, 1956. 5p. NBS Project 0506-20-3280. $1.80(ph OTS); $1.80(mf OTS).

Characteristics of sodium capsule type electrodes were studied, and work was started on a similar electrode of porcelain for use at higher temperatures. (For preceding period see NBS-4746.) (W.L.H.)

10433 NBS-5100

National Bureau of Standards, Washington, D. C.
REFERENCE ELECTRODES FOR MOLTEN SALTS. Progress Report [for] October 1 to December 31, 1956. Vernon A. Lamb and Roger J. Labrie. Jan. 10, 1957. 10p. NBS Project 0506-20-3280. $1.80(ph OTS); $1.80(mf OTS).

The preparation and trail of capsule-type electrodes made from the special porcelain are described. Difficulty was experienced in the firing operation due to warping of the tubes. Two types of electrodes made with porcelain capsules were studied: those in which Na or a Na alloy is placed directly in the bulb and those in which a Ag/AgCl electrode is used in the bulb, with contact to the inside bulb surface made by means of a molten mixture of AgCl and NaCl. (For preceding period see NBS-4881.) (W.L.H.)

10434 NBS-5205

National Bureau of Standards, Washington, D. C.
REFERENCE ELECTRODES FOR MOLTEN SALTS. Progress Report [for] January 1 to March 31, 1957. Vernon A. Lamb and Roger J. Labrie. Apr. 2, 1957. 9p. NBS Project 0506-20-3280. $1.80(ph OTS); $1.80(mf OTS).

The properties of the electrode system Ag/AgCl–NaCl/porcelain, in which the porcelain is in the form of a sodium-ion-conductive capsule were studied. Experiments were carried out in which porcelain electrodes were intercompared and also measured against some of the previously developed electrodes in order to obtain data on the reproducibility, stability, range of usefulness, and durability of porcelain electrodes. (For preceding period see NBS-5100.) (W.L.H.)

10435 ORNL-2327

Oak Ridge National Lab., Tenn.
AN INVESTIGATION OF THE RELATIVE MIGRATORY TENDENCIES OF THE PHENYL AND p-TOLYL GROUPS IN THE PINACOL REARRANGEMENT OF THE 1,1,2-TRIARYLETHYLENE GLYCOL SYSTEM. Lawrence W. Kendrick, Jr. July 19, 1957. 94p. Contract W-7405-eng-26. $0.50(OTS).

10436 AEC-tr-2955

ELECTRON DIFFRACTION STUDY OF THE FORMATION OF THIN LAYERS OF ALUMINUM–ANTIMONY ALLOYS. P. Michel. Translated by K. S. Bevis from Compt. rend. 243, 2063-5(1956). 3p.

An electron-diffraction study was made of the structure of thin layers of Al–Sb alloys obtained by simultaneous or successive vaporization of the pure metals. (W.L.H.)

10437

VAPOR-LIQUID EQUILIBRIA. R. C. Reid, A. B. Reynolds, D. T. Morgan, G. W. Bond, Jr., J. E. Savolainen, and M. L. Hyman (Massachusetts Inst. of Tech. Engineering Practice School, Oak Ridge, Tenn.). Ind. Eng. Chem. 49, 1307-10(1957) Aug.

Vapor-liquid equilibria of the systems HNO_3–HCl, HCl–HNO_3–H_2O, HCl–H_2O, and HNO_3–H_2O were studied for use in the possible design of HCl or HNO_3 gas absorbers. (W.L.H.)

10438

THE IONIZATION OF SULFURIC ACID. Milton Kerker (Clarkson Coll. of Tech., Potsdam, N. Y.). J. Am. Chem. Soc. 79, 3664-7(1957) July 20.

The method of Sherrill and Noyes, based on conductance and transference number, has been used to calculate the ionization of H_2SO_4 at 18 and 50° from data in the literature and to extend the results at 25° to higher concentrations. The results have been compared with those obtained by other methods. The effect of the nature of the counter ion on the equivalent conductance of sulfate and hydrogen ion has been examined. The equivalent conductance of bisulfate ion has been calculated at 18, 25 and 50°. (auth)

10439

Di-t-BUTYLBERYLLIUM AND BERYLLIUM HYDRIDE. E. L. Head, C. E. Holley, Jr., and S. W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 3687-9(1957) July 20.

Methods are described for the preparation of pure di-t-butylberyllium and for the preparation of beryllium hydride (approx. 80 wt. %) by the pyrolysis of both pure di-t-butylberyllium and its etherate. Pure di-t-butylberyllium is a clear, colorless, mobile liquid with a density of 0.65 g./cc. and a freezing point of –16°. When freshly prepared it has a vapor pressure of about 35 mm. at 25°; on standing it undergoes slow decomposition at room temperature with the evolution of isobutene. Beryllium hydride prepared by pyrolysis of di-t-butylberyllium has a density of about 0.57 g./cc., evolves hydrogen slowly at 190 to 200° and rapidly at 220°, is relatively inert to laboratory air, and reacts slowly with water and rapidly with acid. It was analyzed by chemical and microscopic methods. It gave no x-ray pattern. (auth)

10440

NUCLEAR CHEMISTRY AND ITS APPLICATIONS. M. Haissinsky. Paris, Masson and Company, 1957. 657p. (In French)

The scope of this treatment of the broad field of nuclear chemistry is indicated by the table of contents: the history of radioactivity, physics, and nuclear chemistry; the fundamental particles; the nucleus; spontaneous radioactive transformations; nuclear reactions; fission and nuclear reactors; the natural radioelements; isotopic effects and separations; geochemical, geological and astrophysicl applications; dissipation of the energy of radiations in matter; chemical action of ionizing radiations, generalities and reactions in gases; radiolysis of water and aqueous solutions; radiolysis of organic compounds and biological effects of radiations; action of radiations on solids; fluorescence and coloration produced by radiations; chemical effects associated with nuclear transformations; radioactive indicators; isotopic exchange; electrochemical applications; partition of microcomponents between two phases; analytical applications; applications in the study of chemical reaction mechanisms; biochemical and physiological applications of isotopic indicators; technical and industrial applications. (T.R.H.)

ANALYTICAL PROCEDURES

10441 IDO-14316(Suppl. 2)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
SUPPLEMENT NO. 2 TO MANUAL OF THE ANALYTICAL

METHODS USED BY THE CONTROL LABORATORY AT THE CHEMICAL PROCESSING PLANT. PARTS I AND II. M. J. Shepherd, Jr. and J. E. Rein. Mar. 1957. 33p. Contract AT(10-10-205. $0.30(OTS).

10442 NYO-6507

Pittsburgh. Univ.

USE OF ACETYLACETONE EXTRACTIONS IN FERROUS ANALYSIS (thesis). James Patrick McKaveney. 1957. 130p. Contract AT(30-1)-860. $0.65(OTS).

The extraction characteristics of the hydrated ions of Cr^{3+}, Fe^{2+}, Fe^{3+}, Mn^{2+}, Mo^{6+}, Ti^{4+}, V^{3+}, V^{4+}, V^{5+}, and W^{6+} have been investigated using a 1:1 acetylacetone-chloroform solvent mixture. The 1:1 solvent mixture has been successful in removing large quantities of Fe from solutions of ferrous samples. The extraction data for Cr^{3+}, Mo^{6+} and V^{3+} have been used in developing procedures for the analysis of these elements in ferrous materials. (auth)

10443 RDB(W)/TN-109

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

A METHOD FOR THE RAPID DETECTION OF PLUTONIUM DUSTS IN THE AIR. G. M. Wells. Oct. 1953. 13p.

A quick method of detecting and measuring the amount of plutonium present as dust in the air was developed. The method consists of drawing air through a filter paper, ashing the paper quickly and allowing the ash to drop onto a stainless steel tray, where it is then moistened with nitric acid and the remainder of the ash burnt away. The tray is then heated to between 1200°C and 1300°C in a furnace, which boils off all the natural activity, leaving only the Pu, which may then be counted in the normal manner. A method of heating the trays in a vacuum, which consists of passing a heavy electric current through the tray itself, has been developed, but with only reasonable success at present. (auth)

10444

INTEGRATED-CURRENT SOURCE FOR AUTOMATIC COULOMETRIC TITRATIONS. L. E. Smythe (Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks). Analyst 82, 228-33(1957) Apr.

A simple and inexpensive integrated-current source for automatic coulometric titrations has been developed. The unit is suitable for use with a commercial automatic pH titrimeter and may be used with wide variations in main voltage. "Fast" or "slow" coulometric titrations may be carried out with a choice of six current ranges (5 to 100 ma) for titrations up to or near to the end point, and a "slow" 1-ma range for use when approaching the end point. The "fast" and "slow" outputs from the automatic pH titrimeter provided for automatic changing from fast to slow coulometric titrations and stopping at the selected end point. The utility of the equipment is demonstrated by the determination of chromium in dichromate solutions by coulometric titration with electro-generated ferrous ions, use being made of potentiometric end-point detection. The unit should prove suitable for most other coulometric titrations and could be adapted for amperometric and spectrophotometric end-point detection. (auth)

10445

DETERMINATION OF OXYGEN, HYDROGEN, AND NITROGEN IN MOLYBDENUM, TUNGSTEN, AND NIOBIUM. G. V. Mikhaĭlova, Z. M. Turovtseva, and R. Sh. Khalitov. (Vernadskiĭ Inst. of Geochemistry and Analyt. Chemistry). Zhur. Analit. Khim. 12, 338-41(1957) May-June. (In Russian)

The vacuum-fusion method with an iron bath was used for the determination of O_2, H_2, and N_2 in Mo, W, and Nb. The experiments were made in a specially constructed apparatus. (tr-auth)

10446

PHOTOMETRIC DETERMINATION OF TUNGSTEN AND MOLYBDENUM AS RHODANIDE COMPLEXES. A. K. Babko and O. F. Drako. (Inst. of General and Inorganic Chemistry, Kiev Acad. of Sciences). Zhur. Analit. Khim. 12, 342-8(1957) May-June. (In Russian)

The optical density of Mo and W rhodanide complexes depending on their valence, wave length, and the concentration of rhodanide ions has been studied. (tr-auth)

10447

DETERMINATION OF NIOBIUM IN THE PRESENCE OF LARGE AMOUNTS OF Ti. A. I. Ponomarev and A. Ya. Sheskol'skaya (Baĭkov Moscow Inst. of Metallurgy). Zhur. Analit. Khim. 12, 355-8(1957) May-June. (In Russian)

A method for the determination of Nb in the presence of large quantities of Ti has been developed based on the precipitation of Nb with tannin in a 5% solution of hydrochloric acid with ascorbic acid which forms a complex compound with Ti. (tr-auth)

10448

DETERMINATION OF BORON IN ROCKS BY NEUTRON ANALYSIS. V. K. Khristianov and G. I. Panov. (Vernadskiĭ Moscow Inst. of Geochemistry and Analyt. Chemistry). Zhur. Analit. Khim. 12, 362-6(1957) May-June. (In Russian)

A method was developed for the determination of B in minerals and ores without a preliminary chemical treatment of specimens. To avoid the negative effect of hydrogen, the hydrogen content was equal in control specimen and in the analyzed specimen. The accuracy of determination was ± 3% relative. (tr-auth)

10449

METHODS FOR ISOTOPIC ANALYSIS OF WATER. IV. A METHOD FOR COMPLETE ISOTOPIC ANALYSIS OF WATER. A. I. Shatenshteĭn, E. A. Yakovleva, et al. (Karpov Moscow Inst. of Physical Chemistry). Zhur. Analit. Khim. 12, 398-401(1957) May-June. (In Russian)

A semi-micro method is described for the complete isotopic analysis of water containing 0 to 100 at. % of deuterium and 0 to 3.5 at. % of oxygen isotopes. The analysis is carried out with simple apparatus and reagents and takes from 1.5 to 2.5 hr. The analysis is based on the measurements of water density by a drop method before and after the normalization of the isotopic composition of oxygen in the water by contacting the mixture of water vapors and air oxygen on manganese oxide at 500 to 750°, depending on the concentration of oxygen isotopes. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10450 TP-11 (Rpt: UNCLASSIFIED)

United Glass Bottle Manufacturers, Ltd., London.

PERCOLATION IN CRYSTALS. [PART] I. S. R. Broadbent and J. M. Hammersley. [1954]. 22p.

Statistical methods applicable to a study of the physical phenomena affecting the random spread of a fluid through a medium are applied to a theoretical study of percolation in crystals. If the random mechanism involved is ascribed to the fluid, the process is regarded as diffusion, but if the random mechanism is ascribed to the medium the process is called percolation. While some physical situations may be regarded as either diffusion or percolation, others demand one model to the exclusion of the other. An analysis was made of the percolation of fluid in an abstract crystal, homogeneous in the large but possessing local variations. (C.H.)

10451 TP-12
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PERCOLATION IN CRYSTALS. [PART] II. J. M. Hammersley. [1954?]. 12p.
Data are presented from a statistical analysis of percolation in crystals. (C.H.)

10452 TP-13
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PERCOLATION IN CRYSTALS. [PART] III. J. M. Hammersley. [1954?]. 14p.
Data are presented from a statistical analysis of percolation in crystals. (C.H.)

10453
CRYSTALLOGRAPHIC STUDY OF UNIVALENT THALLIUM SULPHATE. N. I. Bashilov and M. N. Lyashchenko. (Kurnakov Inst. of General and Inorganic Chemistry). Doklady Akad. Nauk S.S.S.R. 114, 314-15(1957) May 11. (In Russian)
Goniometric and crystal-optical studies of prepared $Tl_2H_4(SO_4)_3$ crystals revealed crystallization into spicular crystal of α modification and lamellar crystal of β modification. The concentrated and viscous solutions in which the crystallization took place complicated the normal development of crystals. The crystals of $Tl_2H_4(SO_4)_3$ are isotopic. The table of crystal refraction is included. (R.V.J.)

10454
DIRECTIONAL DILATATION OF CRYSTAL LATTICES AT ELEVATED TEMPERATURES. R. J. Beals and R. L. Cook (Univ. of Illinois, Urbana). J. Am. Ceram. Soc. 40, 279-84 (1957) Aug.
The x-ray measurement of lattice parameters of crystals at elevated temperatures provides a means of determining the true thermal expansion of a crystal. In this investigation, a furnace in which temperatures above 1200°C. could be accurately maintained and a specially designed circular back-reflection x-ray camera were employed in measuring the thermal dilatation of crystals representative of the cubic, hexagonal, rhombohedral, and tetragonal systems. Thermal-expansion values up to 1200°C. are reported for magnesia, alumina, zinc oxide, rutile, beryllia, calcium oxide, and strontium oxide and for magnesia-alumina, magnesia-chrome, zinc-alumina, and zinc-chrome spinels. (auth)

FLUORINE AND FLUORINE COMPOUNDS

10455 AERE-C/M-172
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPARATUS FOR HANDLING FLUORINE IN THE LABORATORY. C. J. Mandleberg and H. K. Rae. Feb. 1953. 5p.
An apparatus for handling fluorine on the laboratory scale is described. The fluorine is supplied from commercial cylinders at 400 psi and used at atmospheric pressure. Materials in which to carry out high-temperature fluorinations are discussed. Vacuum valves which will handle fluorine and corrosive fluorides successfully are described as well as reducing valves and control valves for fluorine. (auth)

10456 K-1340
Oak Ridge Gaseous Diffusion Plant, Tenn.
STRUCTURES OF THE INTERHALOGEN COMPOUNDS. II. IODINE HEPTAFLUORIDE AT -145°C AND -110°C. R. D. Burbank and F. N. Bensey, Jr. Aug. 21, 1957. 24p. Contract W-7405-eng-26. $0.75(OTS).
The crystal structure of IF_7 was studied by x-ray diffraction at low temperatures. The molecule has the point group symmetry 2. The I atom is bonded to one F atom at 1.71 A and to three pairs of F atoms at 1.80, 1.83, and 1.85 A. Large differences exist between the observed bond angles and the bond angles of the D_{5h} model proposed from spectroscopic considerations. The validity of the results is obscured by the possibility of systematic error arising from extinction and an inadequate treatment of thermal disorder. (auth)

10457
THE HAMMETT ACIDITY FUNCTION H_0 FOR HYDROFLUORIC ACID SOLUTIONS. Herbert H. Hyman, Martin Kilpatrick, and Joseph J. Katz (Argonne National Lab. and Illinois Inst. of Tech., Lemont). J. Am. Chem. Soc. 79, 3668-71(1957) July 20.
The Hammett acidity function H_0 value has been determined for HF in the concentration range from anhydrous material down to about 40% HF. The dryest HF prepared had an H_0 value of -10.2. In the course of this investigation, improved spectrophotometric cells were developed for handling HF acid solutions and the spectrum of anhydrous HF in the near infrared was determined. The effect of NaF and water on the near infrared HF spectrum was investigated and an analytical method for water in HF was developed based on measurements of the water absorption of 1.95 μ. (auth)

GRAPHITE

10458 IGR-TN/C-540(Add.)
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
MECHANICAL TESTS ON GRAPHITE BLOCKS 1 AND 2. Addendum [to] MECHANICAL TESTS ON GRAPHITE BLOCK 1. E. A. Clough and R. G. Rose. May 1957. 4p.

LABORATORIES AND EQUIPMENT

10459 AERE-ES/M-21
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
LUBRICATION IN DRY BOXES. J. Sheldon. May 1957. 3p.

MOLECULAR STRUCTURE

10460 KAPL-1776
Knolls Atomic Power Lab., Schenectady, N. Y.
SIMPLE MOLECULAR MODELS OF FUSED SALT MELTS. L. Monchick. Apr. 26, 1957. 17p. Contract W-31-109-Eng-52. $0.20(OTS).
A simple cell model of the liquid state was developed to describe fused salt melts. The assumptions required to bring about agreement with experimental data are discussed, as well as the influence of possible complex formation. It is concluded that, knowing the types of ions that will occur, it is possible to predict thermodynamic functions fairly successfully. However, a given set of thermodynamic data may not lead to a unique determination of a molecular model if crude approximations are used. (auth)

RADIATION CHEMISTRY

10461
EFFECTS OF RADIATION ON THE ELECTROCHEMICAL ACTIVITY OF Zr. L. L. Rosenfel'd and E. K. Oshe. (Inst. of Physical Chemistry Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 114, 143-5(1957) May 1. (In Russian)

The relationship between electron radiation intensity and electrochemical activity was evaluated for Zr–Al and Zr–Fe couples in 3% NaCl. (R.V.J.)

10462

PHOTOREDUCTION OF CERIC ION IN SULFURIC ACID SOLUTIONS. EFFECT OF THALLOUS ION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 3655-7(1957) July 20.

Evidence has been obtained for the OH radical an an intermediate in the photoreduction of Ce^{4+} in H_2SO_4 solutions. The observed chemical reaction in the photolysis of $Ce^{4+}-Tl^+$ mixtures is the oxidation of Tl^+ by Ce^{4+}. The initial quantum yield (ΦCe^{+++}) for reduction of Ce^{4+} in the absence of initially added Ce^{3+} is markedly enhanced by Tl^+ but is independent of the Tl^+ concentration (2×10^{-4} M to 2×10^{-2} M). At any particular initial Ce^{3+} concentration, the initial ΦCe^{+++} decreases with decreasing initial Tl^+ concentration. These data obtained in 0.4 M H_2SO_4 are quantitatively interpreted by a mechanism in which Tl^+ competes with Ce^{3+} for reaction with OH radical. The measured value of 42 for $k_{Tl^+, OH}/k_{Ce^{+++}, OH}$ is in agreement with the value of 38 previously determined in 0.4 M H_2SO_4 for the radiolysis of $Ce^{4+}-Ce^{3+}-Tl^+$ for mixtures with cobalt-60 γ-radiation. (auth)

10463

RADICAL PRODUCTION IN THE RADIOLYSIS OF LIQUID BUTANE. Charles E. McCauley and Robert H. Schuler (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 79, 4008-11(1957) Aug. 5.

The distribution of radical species produced during the radiolysis of liquid butane has been studied by the radio-iodine scavenging method. While the radiation yield for formation of total alkyl iodide product increases from a value of 5.6 molecules per 100 ev at an I_2 concentration of 2×10^{-3} M to a value of 9 at 2×10^{-2} M, the yield for each of the monoiodide products is constant. These yields are, respectively, 0.4, 0.9, 0.1, 0.0, 1.0, and 2.1 for methyl ethyl, n-propyl, isopropyl, n-butyl and sec-butyl iodides. The increase in yield of total organic iodides at the greater iodine concentrations is due to a large increase in the yield of higher boiling material which most probably represents diiodide products. The constancy of the yields for the less complex products appears to be an additional indication of the validity of the iodine scavenging method since hydrogen abstraction reactions of the radicals are not affected by changes in the scavenger concentration in the region studied. (auth)

RADIATION EFFECTS

10464 KAPL-1768

Knolls Atomic Power Lab., Schenectady, N. Y.

THE ULTRAVIOLET ABSORPTION SPECTRA ON DIPHENYL, MONO-ISOPROPYL DIPHENYL, AND IRRADIATED MONO-ISOPROPYL DIPHENYL. D. Dutine and J. T. Porter, II. Mar. 28, 1957. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

This report presents the curves for the ultraviolet absorption spectra of diphenyl and mono-isopropyl diphenyl. The spectra of the products resulting from the irradiation of the latter are also reported. (auth)

10465 WADC-TR-56-465

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

ELECTRICAL PROPERTIES OF IRRADIATED POLYMERS. Period Covered: March 1955 to May 1956. Ralph E. Woodard. June 1957. 31p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NUCLEAR RADIATION APPLICATIONS TO ENGINEERING MEASUREMENTS. (AD-130801).

A brief discussion is given of the electronic nature of solids as it applies to insulators and polymers. The fundamental theory of nuclear radiation effects is discussed and shown to be associated with the laws of energy dissipation of these radiation particles within a material. A survey is given on the role that nuclear radiation plays in polymer kinetics. Work of various investigators on the electrical properties of irradiated polymers is reported. An analogy is drawn between photoconductivity in semi-conductors and nuclear radiation induced conductivity in certain polymers. The instantaneous nature of this induced conductivity is emphasized. The change produced in the dielectric constant of an irradiated polymer is considered in terms of cross-linking and dipole moments. A survey is included of the available engineering data for irradiated polymers. Factors affecting radiation to the electrical properties of two tetraarylmonosilanes are given. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

10466

RARE EARTHS IN YTTROTUNGSTITE. J. R. Butler (Imperial Coll. of Science, London). Geochim. et Cosmochim. Acta 12, 190-4(1957).

The rare earth mineral yttrotungstite accords with Goldschmidt's complete assemblage type in containing sensible amounts of Yt and all the lanthanons except Pm and Eu. The relative abundances of the lanthanons in yttrotungstite and in the cosmos are similar except that the ratio La/Ce is substantially higher in the latter. (auth)

10467

ISOTOPE SHIFT IN THE SPECTRUM OF INDIUM I. D. A. Jackson. J. phys. radium 18, 459-67(1957) July. (In French)

The isotope shift in five lines of the arc spectrum of indium has been determined from a comparison by means of a Fabry-Perot interferometer of the wavelengths of these lines emitted by a hollow cathode tube containing natural indium and a similar tube containing indium enriched in In^{113}. The shift has also been measured in one of these lines (4.101 A) by direct measurement of the separation of pairs of components due to the two isotopes, the lines having been resolved in an atomic beam produced with indium enriched in In^{113}, observed in absorption with a double Fabry-Perot etalon. (auth)

10468

SPECTROGRAPHIC DETERMINATION OF SCANDIUM IN MINERALS, ORES, AND THEIR PRODUCTS. S. M. Solodovnik, A. K. Rusanov, and A. I. Kondrashina (Moscow State Research Inst. of Rare Metals). Zhur. Analit Khim. 12, 372-6(1957) May-June. (In Russian)

A direct quantitative spectrographic determination of Sc (0.01 to 0.5%) in minerals is described, and a universal method for determining Sc in different minerals and ores is offered. The method is based on the separation of Sc with calcium on thorium oxalates followed by spectrographic analysis of the resulting oxides with the use of united standards prepared from calcium and thorium oxides. The error of determination is ±10%. (tr-auth)

SEPARATION PROCEDURES

10469 AERE-GP/R-2058(Pt. 1)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THERMAL DIFFUSION PLANT FOR THE ENRICHMENT

OF HELIUM 3 FROM ATMOSPHERIC HELIUM. PART I. EXPERIMENTS TO DETERMINE THE CHARACTERISTICS OF THE INDIVIDUAL COLUMNS. R. W. Bowring. Feb. 1957. 61p.

An atmospheric helium thermal diffusion plant, capable of producing 2cc NTP of Helium 3 per week at concentrations up to 10% He^3/He, has been operating for several years. It consisted of three metal columns, two of them identical coaxial-tube columns and the other a hot-wire column. Experiments are described which were performed on the individual columns to determine the transport coefficient H and the variation of the equilibrium separation factor with pressure. The onset of turbulence in the coaxial-tube column was also investigated. Three methods were used to determine H for the hot-wire column and some anomalous results were obtained which do not agree with the formulas derived by Jones and Furry. The values of the column constants obtained are compared with theory and with the results of other workers. (auth)

10470 IDO-14407

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

STATUS REPORT ON STUDIES OF URANIUM–ALUMINUM ALLOY DISSOLUTION TO A DIBAN DISSOLVER PRODUCT. R. L. Andelin, F. H. Tingey, and C. M. Slansky. June 17, 1957. 45p. Contract AT(10-1)-205. $0.55(OTS).

A series of statistically designed, batch dissolution experiments was conducted with Al–U fuel elements to determine their optimum dissolution rate in HNO_3, with Hg and fluoride catalysts, to an acid-deficient dissolver product. The optimum, average rate to a 4.0M Al, 3.5M acid-deficient solution is 69.8 mg/(cm^2)(hr). The optimum average rate to a 3.0M Al, 2.1M acid-deficient solution is 196.3 mg/(cm^2)(hr). These rates are considered feasible for application to plant processes. (auth)

10471 ISC-796

Ames Lab., Iowa.

CAUSTIC FUSION OF COLUMBITE–TANTALITE CONCENTRATES WITH SUBSEQUENT SEPARATION OF NIOBIUM AND TANTALUM. J. A. Pierret and H. A. Wilhelm. Aug. 1956. 29p. Contract W-7405-eng-82. $0.25(OTS).

A procedure for the production of spectrographically pure niobium and tantalum oxides from columbite–tantalite concentrates was developed. The procedure involves a caustic fusion process and the separation of Ta and Nb by liquid-liquid extraction. The finely ground ore is fused with NaOH. The fused material is cooled and washed with cold water to remove most of the Sn, Si, and Al and part of the Mn. The reddish residue is made into a thick slurry by adding a small amount of water and stirring. Diluted H_2SO_4 (1:1) and Fe powder are added to aid in dissolving the Mn; then more water is added to bring the sulfuric acid to about 1 molar. The insoluble residue which contains the niobic and tantalic acids is recovered by filtration. It is washed and then dried at about 200°C. The dried residue which contains 5 to 10% impurities is dissolved in a minimum amount of 70% hydrofluoric acid. Ta and Nb are extracted from the aqueous hydrofluoric acid solution by the addition of an immiscible organic solvent, leaving most of the impurities in the aqueous phase. By washing the separated organic with portions of a dilute sulfuric acid solution, Nb with a small percentage of Ta is removed from the organic. A small amount of Nb then remains in the Ta-rich organic phase. Pure niobium oxide was obtained by combining all of these aqueous washes and extracting with fresh organic solvent to remove the small percentage of Ta. Pure tantalum oxide was obtained by adding some hydrofluoric acid to the Ta-rich organic phase and extracting with additional dilute sulfuric acid to remove the residual Nb. A comparison of tributyl phosphate–dibutyl ether solution and methyl isobutyl ketone (hexone) as the organic solvent for the extraction is given. The hexone extracted more Nb but less Ta from the hydrofluoric acid solution of the dried residue, but the analytical data indicated a better separation of Nb from Ta with the tributyl phosphate solution. (auth)

10472 KAPL-1692

Knolls Atomic Power Lab., Schenectady, N. Y.

THE BEHAVIOR OF REPRESENTATIVE FISSION PRODUCTS AND PLUTONIUM IN THE KAPL ELECTROREFINING PROCESS AND A REVIEW OF THE STATUS OF THE PROCESS. L. W. Niedrach, A. C. Glamm, and G. R. Fountain. Mar. 27, 1957. 36p. Contract W-31-109-Eng-52. $0.30(OTS).

New decontamination data are presented from multi-throughput runs with the KAPL electrorefining process. It is shown that decontamination from both noble metals and active metals is satisfactory even after as many as 15-bath throughputs. A method is described for calculating the decontamination obtainable by electrorefining from measurements of the distribution coefficient for a fission product, plutonium or other material between the metal and the salt phases. The current status of electrorefining as a method for processing reactor fuels is reviewed. An indication is also given of the types of fuel for which an electrorefining process would be most adaptable. (auth)

10473 KLX-10078

Vitro Labs., West Orange, N. J.

FISSION PRODUCT SEPARATIONS STUDY. Quarterly Progress Report [for] March 1, 1957–May 31, 1957. R. A. Keeler, C. J. Anderson, and M. Kibrick. June 28, 1957. 19p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 994. $0.30(OTS).

Experiments were conducted to study coprecipitation of Sr and a $BaSO_4$ carrier from 5M HNO_3. The evaluation of several silicate and phosphate minerals for the removal of Sr and Cs from fission product wastes was continued. (For preceding period see KLX-10066.) (W.L.H.)

10474 ORNL-2242

Oak Ridge National Lab., Tenn.

STATUS OF THE HERMEX PROCESS. O. C. Dean, E. Sturch, B. H. Morrison, and R. E. Blanco. Aug. 12, 1957. 34p. Contract W-7405-eng-26. $0.30(OTS).

A preliminary flowsheet is presented for the Hermex process, a method for decontaminating irradiated metals and for purifying scrap metals. As applied to uranium, the process consists in dissolving the metal in boiling mercury, recrystallizing and precipitating the metal or its mercuride by cooling the solution, filtering off the metal or alloy crystals, washing the amalgam with dilute acid to further remove contaminants, recovering the metal by volatilizing off the mercury in vacuum or inert gas stream, and melting the resulting sponge to massive metal. The feasibility of a continuous Hermex process for uranium was demonstrated on a 20- to 50-g/day basis, and larger-scale stainless steel equipment was constructed. (auth)

10475 ORNL-2306

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR MARCH 1957. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. July 22, 1957. 31p. Contract W-7405-eng-26. $0.25(OTS).

Systematic Studies. In view of its recently indicated commercial availability at a feasible price, dihexyl hexylphosphonate (DHHP) was examined for use in Dapex synergistic extractant combinations. The synergistic enhancement of uranium extraction by D2EHPA was four-fold greater than that with tributylphosphate, and a little

greater than that with dibutyl butylphosphonate (DBBP). Separation of sodium di(2-ethylhexyl)phosphate from kerosene solution was prevented by concentrations of DHHP similar to those required of TBP or DBBP, and a smaller amount was lost by distribution to the aqueous phase. The rate of loss of three amines from kerosene solution to 0.5 M H_2SO_4 decreased as the percent of amine removed from the organic phase increased with increasing aqueous/organic phase ratio, giving a measure of the selective removal of the more water-soluble components. The loss rate of Amine S-24 became constant at about 9 mg amine per liter of aqueous phase after about 30% had been lost. Loss rates of tri-isooctylamine and Amine 9D-178 decreased to about the same level after 40 and 50%, respectively, had been lost, but without indication of becoming constant. Process Development Studies. Comparative uranium extraction isotherms are presented for a new tertiary amine, i.e., didodecenyl-n-butylamine, and for new samples of tri-isooctylamine, Amine S-24, and Amine 9D-178. Isotherms are also presented for di(tridecyl P) amine with different amounts of alcohol added to the kerosene diluent. The addition of 5% tridecyl alcohol greatly improved the selectivity with respect to iron(III) without depressing the uranium extraction power. In continued studies on Amex processing of monazite sulfate liquors, thorium was effectively extracted with di(tridecyl P)amine. Useful uranium extractions were obtained with tri-n-octylamine. The effectiveness of this reagent was improved by increasing the liquor pH. After thorium and uranium removal, rare earths were extracted and separated from phosphate with Primene JM-T. Chloride, nitrate, and possibly carbonate solutions are effective stripping agents for rare earths. Engineering Studies. Phase separation for the Dapex extraction process was evaluated in a large-scale mixer settler at flow rates up to 60 gpm. The nominal aqueous flow capacity (50% of flooding) was 1.1 gpm/sq ft for organic-continuous dispersions and ranged from 1.5 to 3.9 gpm/sq ft for aqueous-continuous dispersions, depending on the ratio of flow rates. The residual entrainment of organic in the aqueous phase immediately after primary separation was consistently less than 0.01 vol. % for organic-continuous dispersions compared to an average of 0.15 vol. % for aqueous-continuous dispersions. Fundamental Studies. A method has been developed to estimate the bisulfate dissociation and the actual ionic concentrations of H^+, $SO_4^=$, HSO_4^- in a useful range of sulfuric acid–sodium sulfate solutions. The basis for the method and the range of applicability are discussed; results compared favorably with the experimental information now available. Numerical results in terms both of the dissociation quotient $Q = [H^+][SO_4^=]/[HSO_4^-]$ and of the fraction of total sulfate as bisulfate ion are tabulated in sets at constant total sulfate concentrations and at constant ionic strengths. (auth)

10476 ORNL-2326

Oak Ridge National Lab., Tenn.

EXTRACTION OF CHROMIUM WITH TRIOCTYLPHOSPHINE OXIDE. J. C. White and W. J. Ross. July 22, 1957. 37p. Contract W-7405-eng-26. $0.30(OTS).

Chromium in the hexavalent state is readily extracted by tri-n-octylphosphine oxide (TOPO) from acidic sulfate and chloride solutions. When present in the trivalent form, chromium is not extractable under any condition tested. Thus TOPO provides an excellent reagent for the separation by solvent extraction of the two common oxidation states of chromium. Chromium is quantitatively extracted in a single equilibration from chloride solutions that are to 7M HCl and from sulfate solutions that are 1 to 4M H_2SO_4. In hydrochloric acid, approximately 12 mg of chromium are extracted quantitatively by 0.5 millimole of TOPO; in sulfuric acid, nearly 20 mg are extractable with the same concentration of reagent. The loading capacity of this concentration of reagent is 21 mg for hydrochloric acid solutions, 30 mg for sulfuric acid solutions. The time required to reach equilibration is extremely short; for example, 10 mg of chromium are extracted completely after equilibration for one minute. Extremely large volume phase ratios are tolerable, particularly in hydrochloric acid solutions. Complete extraction is attainable in a single equilibration from a V_a/V_o ratio of 10. In sulfate solutions the maximum phase ratio is three. The addition of excess anion in the form of a neutral salt retards extraction in both chloride and sulfate media. The extraction coefficient for chromium is 2.6 for a solution of 1M HCl, and 0.1 to 2M NaCl as compared to about 100 for 1M HCl alone. In 1M H_2SO_4, 0.5 to 2M Na_2SO_4, the extraction coefficient is approximately 15 as compared to 30 for 1M H_2SO_4. In both chloride and sulfate systems the extractable species is $H_2Cr_2O_7 \cdot 2TOPO$. The extraction of chromium from nitrate, phosphate, and perchlorate systems is incomplete. In nitrate systems at high acidities, the hexavalent chromium acts as a strong oxidant. For this reason, although considerable chromium is extracted under favorable conditions, extraction is not recommended for nitrate solutions. In neither perchlorate nor phosphate systems, is the extraction sufficiently complete for efficient application. The solvent in which the TOPO is dissolved has little effect on the extraction of chromium. Essentially, no difference in the degree of extraction is obtained if the TOPO is dissolved in cyclohexane, carbon tetrachloride, or nitrobenzene. This relationship is in sharp contrast to the effect of solvent on the extraction of uranium with TOPO where, in general, the higher the polarity of the solvent the lower the extraction coefficient. (auth)

10477 ORNL-2339

Oak Ridge National Lab., Tenn.

EVALUATION OF SIEVE PLATES FOR STEAM STRIPPING OF TBP FROM EVAPORATOR FEED STREAMS. C. V. Chester. July 31, 1957. 14p. Contract W-7405-eng-26. $0.20(OTS).

Tests of a 6-in.-diam sieve plate column with downcomers on the $UO_2(NO_3)_2-H_2O-TBP$ system showed average plate efficiencies of 25% for a plate with 2.73% free area over a range of f factors from 0.2 to 0.7 at an L/V of 1.15. The efficiency decreased above f = 0.7. (The f factor is the product of superficial vapor velocity and the square root of vapor density.) Uranium entrainment in the six-plate column (top two plates dry) was of the order of 50 to 100 μg/liter of condensate at f factors from 0.2 to 0.5. At f = 0.7, entrainment rose to about 300 μg/liter. This entrainment was reduced to less than 100 μg/liter by admitting water as reflux to the sixth plate at a rate equal to 10% of the feed rate. The column flooded at an f factor of about 1.0, and began to weep with f between 0.1 and 0.2. (auth)

10478 RMO-2802

Colorado School of Mines Research Foundation, [Inc.], Golden.

RECOVERY OF URANIUM VALUES FROM ORE AND CONCENTRATE SAMPLES. Progress Report No. 2. Apr. 22, 1955. 168p. CSMRF Project No. 530208. Contract AT(49-6)-916. $1.00(OTS).

Froth flotation is the most effective method for concentration of this ore of the processes tested. The flotation process also offers the advantage over other processes of not requiring sizing of the feed into several fractions. The objective of a concentrate containing 0.25% U_3O_8 with an 80% recovery is not obtained with this flotation process in its present state of development; however, a concentrate containing 0.25% U_3O_8 with a 75% recovery or a recovery of 80% of the U_3O_8 in a concentrate containing 0.21% U_3O_8 is

obtained. The flotation process in its present state of development consists of stage feeding an emulsion of fatty acid, fuel oil, and petroleum sulfonate collector during rougher flotation to a pulp at a pH of 6.0. The rougher concentrate is then cleaned several times by flotation with the cleaner tailings being returned to rougher flotation. The amount of slime present in the flotation feed product is a very important factor, as selective flotation of this ore is poor on fractions smaller than 20-micron size. The production of slime during grinding is minimized to some extent by stage grinding and by using a slow grinding mill speed with a high pulp density in the mill. The Buckman Table and the Round Table are not effective for concentration of the slime fraction of this ore. Combination gravity and magnetic processes are not as effective as flotation for the concentration of this ore. (auth)

10479 RMO-2804

Colorado School of Mines Research Foundation, [Inc.], Golden.

RECOVERY OF URANIUM VALUES FROM ORE AND CONCENTRATE SAMPLES. PILOT PLANT TEST OPERATIONS. Progress Report No. 4. June 30, 1955. 41p. CSMRF Project No. 530208. Contract AT(49-6)-916. $0.50(OTS).

The objective of this project, which was to produce a concentrate containing 0.25% U_3O_8 with a recovery of 80% of the U values, is obtainable by the froth flotation process. The process developed in the laboratory is adaptable to a continuous process using plant-type equipment of standard design. The U_3O_8 content of the concentrate can be increased to 0.28 to 0.29% U_3O_8, but at a recovery of approximately 78% of the U_3O_8. The recovery of the U_3O_8 can be increased to approximately 84%, but with a concentrate containing 0.22 to 0.23% U_3O_8. The process consists of conditioning the flotation feed pulp for regulation of pH and depression of gangue minerals. The size distribution of the ground ore is a critical factor, as the presence of an excessive amount of slimes in the flotation circuit impairs both the metallurgical results and the operational control. Retreatment of the flotation rougher tailing by classification and regrind of the sand fraction lowers the per cent of U_3O_8 in the final tailing product. Desliming of the cleaner tailing prior to retreatment aids the operation of the flotation circuit by permitting more liberal use of cleaner dilution water. (auth)

10480 WIN-54

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF DAKOTA LIGNITES. R. J. Woody, D. R. George, H. Petrow, John B. Breymann, and E. S. Porter. Apr. 1, 1957. 173p. Contract AT(49-6)-924. $1.00(OTS).

A laboratory investigation into methods of U recovery from Dakota lignites is summarized. A flowsheet is recommended for pilot plant testing. (auth)

10481 WIN-75

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

PILOT PLANT TESTING OF SOLVENT EXTRACTION OF ACID RIP PREGNANT ELUATES. W. D. Charles, H. E. Gardner, M. A. Peters, and R. L. Shimmin. June 10, 1957. 42p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

Sulfuric acid elution was substituted for nitrate elution in the Acid Resin-In-Pulp Pilot Plant. The pregnant eluate was subjected to solvent treatment in a pulse column and in mixer-settlers. The extractant was di-2-ethyl hexyl phosphoric acid. Detailed information on sulfuric acid elution of ion exchange resin, solvent extraction of pregnant eluate, and precipitation of pregnant carbonate solution is presented. (auth)

10482

APPLICATION OF COMPLEXONE III FOR CHROMATOGRAPHIC SEPARATION OF Rb AND Cs. A. P. Smirnov-Averin, G. B. Kostarev, and N. N. Krot. Zhur. Analit. Khim 12, 313-17(1957) May-June. (In Russian)

A review is given of physical and chemical properties of complexone III and its application in chromatographic separation on Rb and Cs. Results show that about 90% separation of pure Rb and 65% of Cs has been achieved. (R.V.J.)

10483

EXTRACTION OF NIOBIUM RHODANIDE COMPLEXES WITH ORGANIC SOLVENTS USING RADIOACTIVE ISOTOPES Nb^{95}. K. V. Troitskif (Vernadskfi Moscow Inst. of Geochemistry and Analyt. Chemistry). Zhur. Analit. Khim. 12, 349-54(1957) May-June. (In Russian)

Optimum conditions have been found for the extractive separation of Nb, and the best solvents are suggested. (tr-auth)

10484

SEPARATION OF TITANIUM FROM ACCOMPANYING ELEMENTS BY ION-EXCHANGE CHROMATOGRAPHY. II. SEPARATION OF Ti AND Cr. I. P. Alimarin, T. A. Belyavskaya, and L. A. Bazhanova (Lomonosov Moscow State Univ.). Zhur. Analit. Fiz. 12, 377-80(1957) May-June. (In Russian)

A method has been developed for the quantitative chromatographic separation of Ti and Cr at the ratios Ti : Cr from 1 : 100 to 10.00 : 1 with 0.5% solution of complexone III. (tr-auth)

SPECTROSCOPY

10485 AERE-C/R-517

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EXTRACTION SOLVENT. PART 2. THE INFRARED ABSORPTION SPECTRA OF BUTEX AND ALLIED COMPOUNDS. J. Gaunt and G. M. Meaburn. Aug. 1950. Decl. Apr. 2, 1957. 27p.

The infrared spectrum of crude Butex has been examined and a number of absorption bands have been found which are attributed to the presence of hydroxylic, carbonyl and unsaturated impurities. The spectra of three probable impurities have also been examined and an attempt has been made to correlate the impurity bands in Butex with certain absorption bands in these compounds. The spectra of a number of compounds similar in structure to Butex have been plotted and an attempt is made to correlate a number of bands common throughout the series with certain types of molecular oscillation. The spectra and position of the bandheads are recorded in the text. (auth)

10486 AEC-tr-2760

NEW METHODS OF USING MULTIPLEX ETALONS IN HIGH RESOLUTION SPECTROSCOPY. F. A. Korolev. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 78(1955). 3p.

TRACER APPLICATIONS

10487 AERE-CE/R-1283

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

RADIOMETRIC STUDIES WITH PHOSPHORUS-32 LABELLED TRI-n-BUTYL PHOSPHATE. PART I. SOLUBILITY AND DISTRIBUTION STUDIES. J. Kennedy and

S. S. Grimley. Dec. 1, 1953. Decl. Apr. 2, 1957. 22p.

The distribution of tri-n-butyl phosphate between various organic solvents and aqueous salt solutions has been measured over a range of tributyl phosphate concentrations using radiometric methods of analysis. The results are interpreted in terms of salting out effects and in terms of a regular variation in the activity coefficients of the solute species in the solvent phase. (auth)

10488 AEC-tr-2873

THEORETICAL PRINCIPLES OF ISOTOPE METHODS FOR INVESTIGATING CHEMICAL REACTIONS. (Teoreticheskie Osnovy Izotopnykh Metodov Izucheniya Khimicheskikh). S. Z. Roginskii (Roginsky). Translated from a publication of the Academy of Sciences U. S. S. R., Moscow, 1956. 456p. $2.20(OTS).

The applications of isotopes in investigations of the mechanisms of chemical transformations and of the reactivity of substances are reviewed. Topics discussed in detail include: thermodynamic isotopic effects, the kinetics of uncomplicated isotopic exchange, mechanisms and stages of isotopic exchange, isotope effects in chemical kinetics, the kinetics of complicated isotopic exchange, and the main fields of application and development prospects of isotope methods in chemical kinetics. Appended are tables of thermodynamic functions of isotopic molecules, equilibrium constants for isotopic exchange, and data on kinetic isotopic effects. 884 references. (C.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

10489 AERE-C/R-662

Gt. Brit. Atomic Energy Research Establishment, Harwell, England.

THE PREPARATION OF PLUTONIUM TRIFLUORIDE AND TETRAFLUORIDE BY THE USE OF HYDROGEN FLUORIDE. J. K. Dawson and A. E. Truswell. Feb. 22, 1951. Decl. Apr. 2, 1957. 6p.

The reaction of plutonium oxalate or oxide with gaseous HF results in the production of the trifluoride only. This is believed to be due to a trace of reducing impurity in the HF which is removed by the addition of O_2 or air. Consequently, PuF_4 may be prepared at 500 to 550°C by reaction of the oxalate, oxide, or trifluoride with HF containing a partial pressure of air. At temperatures higher than 700°C the Pu is completely volatilized. (auth)

10490

ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. V. THE Np(V)–Np(VI) EXCHANGE IN D_2O. J. C. Sullivan, Donald Cohen, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 3672-4(1957) July 20.

10491

THE HYDROLYSIS OF PLUTONIUM(IV). Sherman W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 3675-7(1957) July 20.

The hydrolysis quotient, $(PuOH^{+++})(H^+)/(Pu^{+4})$, has been evaluated in $LiClO_4$–$HClO_4$ solutions at a constant total molarity of two from measurements of the Pu^{3+}–Pu^{4+} formal potential as a function of acidity. The temperature dependence of this hydrolysis quotient was obtained from formal potential measurements at 14.88, 25.00 and 34.35°; the value of ΔH for the reaction $Pu^{+4} + H_2O \rightleftharpoons PuOH^{+++} + H^+$ was computed to be 7.3 ± 0.5 kcal/mole. At 25° the value of ΔF is 1.73 ± 0.01 kcal/mole; hence, $\Delta S = 19 \pm 2$ e.u. The value of ΔH for the reaction $Pu^{+3} + H^+ \rightleftharpoons Pu^{+4} + \frac{1}{2}H_2$, in 2 M $HClO_4$ at 25° was found to be 13.3 ± 0.5 kcal/mole which is very nearly equal to the value obtained previously for this reaction in molar $HClO_4$. Virtually identical Pu^{3+}–Pu^{4+} formal potentials were obtained in those cases in which $NaClO_4$ was used to replace $LiClO_4$ as the added salt to maintain an ionic strength of two in the solutions. Thus, it would appear that the concentration of the ClO_4 plays a more significant role than the Na^+ or Li^+ in determining the value of the activity coefficient ratio $\gamma^5 \pm Pu(ClO_4)_4/\gamma^4 \pm Pu(ClO_4)_3\ \gamma^2 \pm HClO_4$. (auth)

10492

KINETICS OF REACTIONS INVOLVING NEPTUNIUM(IV), NEPTUNIUM(V) AND NEPTUNIUM(VI) IONS IN SULFATE MEDIA. J. C. Sullivan, Donald Cohen, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 4029-34(1957) Aug. 5.

The rates of the forward and reverse reactions involved in the equilibrium $Np^{4+} + Np^{6+} \rightleftharpoons 2Np^{5+}$ have been measured in sulfate solution. Both forward and reverse reactions involve multiple parallel reaction paths. The rate of the forward reaction can be expressed in the form $R = k_0'[Np^{4+}][NpO_2^{2+}][H^+]^{-2} + \{k_1[NpSO_4^{2+}][NpO_2^{2+}] + k_2[NpSO_4^{2+}][NpO_2SO_4]\}\{k_3[H^+]^{-2} + k_4[H^+]^{-3}\}$. At 25° and $\mu = 2.2$, $k_0' = 2.69$ mole $l.^{-1}$, $k_1 = 4.27$ mole^{-1} l. min.$^{-1}$, $k_2 = 7.12$ mole^{-1} l. min.$^{-1}$, $k_3 = 3.6$ mole^2 $l.^{-2}$ and $k_4 = 1.7$ mole^3 $l.^{-3}$. The rate of the disproportionation reaction may be represented by $R = \{k_5[NpO_2^+]^2[HSO_4^-] + k_6[NpO_2^+]^2[HSO_4^-]^2\}\{k_7 + k_8[H^+]\}$. At 25° and $\mu = 2.2$, $k_5 = 0.30$ mole^{-2} $l.^2$ min.$^{-1}$, $k_6 = 0.090$ mole^{-3} $l.^3$ min.$^{-1}$, $k_7 = 0.74$, and $k_8 = 0.14$ mole $l.^{-1}$. Apparent activation energies are given. Probable restrictions on the geometrical configurations for the transition state complexes and the mechanism of the electron transfer processes are considered. Relationships of the reactions in sulfate solution to similar reactions occurring in perchlorate media are discussed. (auth)

10493

PLUTONIUM ALKOXIDES. D. C. Bradley, B. Harder, and F. Hudswell (Atomic Energy Research Establishment, Harwell, near Didcot, Berks). J. Chem. Soc. 3318(1957) July.

Since Pu appears not to form stable anhydrous tetrachloride, preparation of plutonium(IV) tetra-alkoxides started from the stable pyridinium chloride complex $(C_5H_6N)_2PuCl_6$. The complex chloride, when treated in suspension in benzene-propan-2-ol with excess NH_3, gave a soluble product corresponding in analysis to a mixture of $Pu(OPr)_4$ and $Pu(OPr)_4 \cdot C_5H_5N$. The Pu product, on crystallization from propan-2-ol, gave an emerald-green solvate $Pu(OPr)_4 \cdot PrOH$. (W.L.H.)

10494

ANALYTICAL CHEMISTRY OF NEPTUNIUM. I. P. Alimarin and Yu. A. Zolotov. Uspekhi Khim. 26 625-38 (1957) June. (In Russian)

A review is given of the data on chemical analysis, separation, and extraction of Np. (R.V.J.)

URANIUM AND URANIUM COMPOUNDS

10495 AERE-C/M-300

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REACTION BETWEEN URANIUM HEXAFLUORIDE AND SULPHURIC ACID. D. Davies. Feb. 1957. 6p.

A preliminary investigation of the hydrolysis of uranium hexafluoride by concentrated sulfuric acid has been made. The reaction proceeds smoothly to give a precipitate of U^{VI} sulfate with only slight reduction to U^{IV}. (auth)

10496 AERE-M/R-509

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MACROSTRUCTURAL EXAMINATION OF CAST URANIUM BARS. B. W. Mott and H. R. Haines. Apr. 1950. Decl. May 1, 1957. 14p.

A method of etching U sections to reveal the macrostructure is described, and the results of examination of sections from various cast bars of 1.0 and 1.4 inch diameter are given. The report includes a discussion of the significance of the variations in appearance of the grain structures together with suggestions as to the relative behavior of the bars under thermal cycling or irradiation, confirmation of which has been provided by the results of thermal cycling tests to date. It is postulated that preferred orientation may exist in cast bars which solidify with a columnar structure and this has been confirmed using a photomultiplier unit in conjunction with a polarizing microscope. (auth)

10497 AERE-M/R-799

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RATE OF GROWTH OF UAl_3 LAYERS OF ALPHA URANIUM. J. R. Murray. Oct. 15, 1951. Decl. Apr. 16, 1957. 16p.

The rate of growth of UAl_3 layers into alpha uranium has been measured on discs coated with aluminum by dipping in baths of the molten metal and annealing the prepared samples at various temperatures in the range 200 to 550°C. From the results, a figure of 22.0 ± 0.7 kcals./gm. atom has been derived for the activation energy for the diffusion of aluminum into uranium. No evidence was obtained to indicate that uranium had diffused into solid aluminum or that the rate of diffusion was affected by the presence of grain boundaries or orientation of the annealed uranium grains. Diffusion was found to be inhibited by the presence of a halide flux but not appreciably by the presence of iron and nickel present together in amounts of 2000 and 1,200 ppm, respectively. (auth)

10498 AERE-M/R-1281

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE URANIUM–STEAM REACTION. R. A. U. Huddle. Nov. 1953. Decl. Apr. 16, 1957. 18p.

Experiments on the rate of reaction between uranium and steam at temperatures up to 600°C are described. The rate increases rapidly above 200°C reaching a maximum in the range 250 to 400°C; above this temperature it drops considerably, remaining practically constant between 450 and 600°C. The heats and free energies of the fundamental reactions of the system, uranium–steam, have been calculated for temperatures up to 5000°K. A new theory why oxide scales of some metals are protective whereas others flake or powder is presented. It is suggested that the Pilling-Bedworth ratio (the ratio of the volume of oxide produced to the volume of metal destroyed) is inappropriate and that protection is a function of the sintering characteristics of the oxide at its formation temperature. The results are discussed in relation to the kinetics of the uranium–steam and uranium–oxygen reactions which in turn are related to the problems associated with sudden failure of a water-cooled reactor. It is unlikely that any serious explosion will result from the chemical energy associated with this reaction. (auth)

10499 BMI-1192

Battelle Memorial Inst., Columbus, Ohio.

THE REACTION OF STEAM WITH URANIUM AND WITH VARIOUS URANIUM–NIOBIUM–ZIRCONIUM ALLOYS AT HIGH TEMPERATURES. Alexis W. Lemmon, Jr. June 17, 1957. 75p. Contract W-7405-eng-92. $0.45(OTS).

To provide data for evaluating the possible extent of the chemical reaction of steam with U and various U–Nb–Zr alloys when contacted at high temperatures in nuclear reactors, two experimental studies were performed. These were concerned with (1) measurement of metal–water reaction rates and (2) emissivity determinations. In addition, it was necessary to perform an experimental program to determine methods for preparing and to prepare the test specimens for the measurement programs. The materials studied were (1) unalloyed U, (2) U–10 wt. % Nb, (3) 75 wt. % (U–10 wt. % Nb) – 25 wt. % Zircaloy 2, (4) 50 wt. % (U–10 wt. % Nb)–50 wt. % Zircaloy 2, and (5) 25 wt. % (U–10 wt. % Nb)–75 wt. % Zircaloy 2. In general, it was found that solid U was the most reactive (with steam at 50 psia) of all materials studied with the exception of the solid 75 wt. % (U–10 wt. % Nb)–25 wt. % Zircaloy 2 alloy which behaved in an anomalous fashion. The solid U–10 wt. % Nb alloy had the lowest reactivity and the solid 50 wt. % and 25 wt. % (U–10 wt. % Nb) alloys had reaction rates with steam intermediate between U and the U–10 wt. % Nb alloy and comparable with those of solid Zircaloy 2 previously studied. The variation of reaction rate with steam pressure was not investigated; some variation with steam-flow rate was noted, but was not shown conclusively to be a factor. The reaction rate of steam with all materials in the molten state did not appear to be affected by variations in the molten-metal temperature or by differences in composition. Spectral and total emissivities were measured for all materials in the as-rolled condition and with O_2 added. Total emissivities for the as-rolled materials ranged from 0.33 at 850°C for the 75 wt. % (U–10 wt. % Nb) alloy to 0.41 at 1075°C for the U–10 wt. % Nb alloy. Total emissivities with O_2 added to the specimens ranged from 0.35 at 850°C for the 75 wt. % (U–10 wt. % Nb) alloy to 0.67 at 1075°C for the U–10 wt. % Nb alloy. Spectral emissivities for the as-rolled materials ranged from 0.32 at 850°C for unalloyed U to 0.72 at 1075°C for the 75 wt. % (U–10 wt. % Nb) alloy. Spectral emissivities with O_2 added ranged from 0.19 at 1075°C for unalloyed U to 0.72 at 1075°C for the U–10 wt. % Nb alloy. In the preparation of specimens, all alloy ingots were prepared by the duplex-melting process in which the ingot is produced by a vacuum-induction melting step followed by a remelting as the consumable electrode of an arc-melting furnace. The ⅝-in.-diameter bar stock was produced by forging and rolling, while several annealing, quenching, and rolling steps were required to produce the 5-mil sheet for the emissivity measurements. (auth)

10500 IGO-AM/W-97

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF URANIUM IN AQUEOUS AND ORGANIC SOLVENT SOLUTIONS (POLAROGRAPHIC METHOD). H. A. Wright and F. Elliott. June 19, 1957. 9p.

Solvent samples are evaporated with nitric acid and then with perchloric acid to destroy organic matter; aqueous samples are evaporated with nitric acid to destroy organic matter. Solutions from the aqueous and solvent sample pretreatment are fumed with perchloric acid to remove the last traces of organic material. Oxidizing agents are reduced with hydrazine, and the uranium is determined by an a-c polarographic method. (auth)

10501 IGRL-T/W-39

THE DENSITIES OF AQUEOUS SOLUTIONS AND APPARENT MOLAL VOLUMES OF URANYL NITRATE. A. F. Kapustynskii (Kapustynsky) and E. E. Lipilena. Translated by T. H. Boyd from Izvest. Akad. Nauk S.S.S.R. Otel. Khim. Nauk 6, 649-57(1956). 10p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11: 219.

10502 NLCO-682

National Lead Co. of Ohio, Cincinnati.

A THERMOBALANCE INVESTIGATION OF STARCH AS A REDUCING AGENT IN THE CONVERSION OF URANIUM

TRIOXIDE TO URANIUM TETRAFLUORIDE. G. G. Briggs. Aug. 8, 1956. 26p. Contract AT(30-1)-1156. $1.00(OTS).

The reactions involved in the laboratory reduction and hydrofluorination of hydrated pellets prepared from a mixture of pot-denitrated UO_3 and cornstarch were studied. The starch performed the function of reducing the uranium from the hexavalent state to the tetravalent state. The UO_3–starch pellets were reduced to UO_2 fairly rapidly at temperatures above 1100°F in an atmosphere of nitrogen. Some of the reduction appeared to take place at temperatures as low as 600°F, when the starch was undergoing rapid thermal decomposition. The UO_2 produced was very reactive towards subsequent hydrofluorination, but reduction temperatures exceeding 1300°F appeared to diminish this reactivity. Reduction and hydrofluorination of UO_3–starch pellets were also performed simultaneously in the thermobalance. The rate-controlling reaction in this case appeared to be the reduction of UO_2F_2 by the carbon of the starch. Attempts to remove the residual carbon from the UO_2 pellets by contacting them with steam or carbon dioxide at elevated temperatures were unsuccessful as the carbon content of the final UF_4 remained far above the specified level for metal-grade UF_4. (auth)

10503

A VERY SENSITIVE MICROGRAPHIC DETECTION METHOD FOR HYDROGEN IN ALPHA URANIUM. Andre Robillard and Daniel Calais. Compt. rend. 245, 59-62 (1957) July 1. (In French)

The ring phase has been identified as UH_3. The thermal treatment is defined which permits the best conditions for detection of the traces of hydrogen in α uranium in the form of hydride. (tr-auth)

10504

MECHANISM OF FORMATION OF POLYGONIZATION SUBSTRUCTURES OBSERVED IN α URANIUM AFTER γ PHASE THERMAL TREATMENT. Andre Robillard and Daniel Calais. Compt. rend. 245, 309-12(1957) July 17. (In French)

The sub-structure in α-uranium after γ-annealing following by tempering can be interpreted as being the evidence of the polygonization of the β phase due to a γ-β transformation. Some analogous treatments of Cr–U alloys having 1.4 at. % Cr, where the β phase could be stabilized by tempering at ordinary temperatures, confirm this interpretation. (tr-auth)

10505

THE HEAT OF DILUTION OF AQUEOUS URANYL ACETATE SOLUTIONS. B. C. L. Salman and A. G. White (Atomic Energy Research Establishment, Harwell, near Didcot, Berks). J. Chem. Soc. 3197-3202(1957) July.

The heat of dilution of aqueous uranyl acetate solutions at 25° has been measured over a concentration range 0.17 to 0.00002 molal. The results are discussed in terms of the complex-ion formation and hydrolysis processes. (auth)

10506

NEW WAYS IN ISOTOPIC ANALYSIS OF URANIUM. J. E. Lovett and J. O. Roberts (U. S. Atomic Energy Commission, Washington). Nucleonics 15, No. 7, 72-5(1957) July.

Applications of emission spectrograph, neutron activation, and γ and α counting for the isotopic analysis of U for U^{235} content are discussed. Accuracy and cost of the methods are compared with analysis using mass spectrometry. (C.H.)

10507

STEPS IN PREPARING URANIUM DIOXIDE FOR FUEL ELEMENTS. H. H. Hausner (Penn-Texas Corp., New York) and R. G. Mills (General Electric Co., San Jose, Calif.). Nucleonics 15, No. 7, 94-103(1957) July.

WASTE DISPOSAL

10508 AERE-C/R-340

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SORPTION OF FISSION PRODUCT MIXTURES IN RELATION TO EFFLUENT DISPOSAL. G. B. Cook and J. Wilkinson. Dec. 1948. Decl. Apr. 2, 1957. 14p.

Possible methods for the disposal of radioactive β-active effluent are considered, and the previous work on the absorption of fission-product mixtures in aqueous solution is reviewed. A method is developed for the sorption of greater than 99% of the fission products from dilute acid solution on a mixture of soil and barium sulfate for the treatment of laboratory effluent. It is proposed that the secondary plutonium plant solutions be treated with ferric or aluminum hydroxides which adsorb 96% of the fission products from alkaline solutions. 15 references. (auth)

10509 CF-57-1-139

Oak Ridge National Lab., Tenn.

THE ALKALINE METHOD FOR TREATMENT OF HIGH RADIATION LEVEL ALUMINUM WASTES. I. R. Higgins. Jan. 17, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A method is proposed for the treatment and disposal of high radiation level Al wastes. A simplified version may also be used for treatment of other than Al-containing wastes. (W.L.H.)

ENGINEERING

10510 LM/TAB-4

Mine Safety Appliances Corp., Callery, Penna.

LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD JANUARY 1 TO May 31, 1957. June 18, 1957. 28p.

10511 NP-6362

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

BIBLIOGRAPHY ON SHELLS AND SHELL-LIKE STRUCTURES (1954-1956). William A. Nash. June 1957. 46p. Contract DA-01-009-ORD-404.

Books and papers published from 1953 through 1956 pertinent to experimental and theoretical work on shells and shell-like structures are listed. The entries are listed alphabetically by authors, and a subject index is included. (C.H.)

10512 OSR-TN-57-183

Columbia Univ., New York. Electronics Research Labs.

THEORY OF TIME-VARYING SAMPLED-DATA SYSTEMS. Bernard Friedland. Apr. 15, 1957. 218p. Project R-357-50-3. Contract AF18(600)-677. (CU-31-57-AF-677-EE; T-19/B; AD-126478).

HEAT TRANSFER AND FLUID FLOW

10513 CF-57-6-7

Oak Ridge National Lab., Tenn.

EFFECT OF SLURRY PHYSICAL PROPERTIES ON HEAT EXCHANGERS AND PUMP CHARACTERISTICS. D. G. Thomas. June 10, 1957. 33p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Design calculations were made for a system consisting of a pump, one hundred feet of pipe, and a heat exchanger to remove 1 Mw of heat from various aqueous thorium oxide slurries. The rheological properties of the slurries were

varied over a range of yield stresses from 0 to 1.5 lb/sq ft and of coefficients of rigidity from $\frac{1}{2}$ to 2 centipoise. Two different cases were studied: a heat exchanger having fixed axial and radial ΔT in which the tube length was allowed to vary and a heat exchanger having fixed tube length in which the axial and radial ΔT were allowed to vary. It was shown that the pump power must be increased by a factor of 15 to 30 in order to maintain satisfactory operation of the heat exchanger as the slurry yield stress is increased from 0 to 1.5 lb/sq ft. However the pump power is essentially independent of heat exchanger tube diameter for any given slurry. The rated capacity of a slurry heat exchanger is essentially independent of slurry yield stress and coefficient of rigidity, provided that the tube velocity can be suitably increased as the slurry yield stress is increased. (auth)

10514 IGRL-T/W-12

CONTACT HEAT TRANSFER BETWEEN MACHINE COMPONENTS. E. P. Diban, N. M. Kondac, and I. T. Shvets. Translated by V. H. Brix from Izvest. Akad. Nauk S.S.S.R. 9, 63-79(1954). 20p.

10515 KAPL-M-DJO-3

Knolls Atomic Power Lab., Schenectady, N. Y.

HEAT TRANSFER AND FLUID FLOW PERFORMANCE OF A NUMBER OF SIMPLE FUEL ELEMENT CONFIGURATIONS. D. J. Oakley. May 15, 1957. 32p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

A number of fuel element configurations have been investigated from a heat transfer and fluid flow aspect. Identical heat transfer performance can be obtained on a unit volume basis for the same metal fraction (i.e., packing) for the following geometrical configurations: tubes with axial fluid flow, rods with axial fluid flow, flat plates, and diamond plates. The main distinction was the size of the individual elements necessary. Tubes with axial fluid flow appear most advantageous. This is based upon the fact that the same thermal performance per unit volume is obtained with larger sized fuel elements, with little need of extensive structural supports. Use of the attached graphs permits a rapid evaluation of the heat transfer and fluid flow aspects of a preliminary reactor design. Operating points of two reference designs are shown as comparisons. (auth)

10516 LA-2129

Los Alamos Scientific Lab., N. Mex.

PRESSURE-TEMPERATURE RELATION FOR CONSTANT-AREA COMPRESSIBLE FLOW OF A GAS, CONSIDERING HEAT TRANSFER AND FRICTION WITH CONSTANT WALL TEMPERATURES. Franklin P. Durham. Jan. 8, 1957. 81p. Contract W-7405-Eng-36. $0.50(OTS).

A relation is derived between stagnation pressure and stagnation temperature with Mach number as a parameter for the case of constant-area compressible flow of a gas, considering both heat transfer and friction under conditions of constant wall temperature. The relation is independent of flow length and the absolute value of either the friction coefficient or heat transfer coefficient, but does depend on a modified Reynolds analogy parameter relating local values of the heat transfer coefficient and friction coefficient. The results of a machine computation are presented in a series of graphs that are useful for rapid estimation of pressure drop in terms of temperature rise and inlet flow conditions in cases where the heat transfer surface temperature may be considered approximately constant. (auth)

MATERIALS TESTING

10517 NACA-TN-3778

Lewis Flight Propulsion Lab., Cleveland.

ANALYSIS OF ELASTIC THERMAL STRESSES IN THIN PLATE WITH SPANWISE AND CHORDWISE VARIATIONS OF TEMPERATURE AND THICKNESS. Alexander Mendelson and Marvin Hirschberg. Nov. 1956. 41p.

An approximate method for calculating thermal stresses in a thin plate with variable thickness and temperature distributions in both the spanwise and chordwise directions is presented. Several examples are worked out and plotted. (auth)

10518 TML-70

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

SURVEY OF THE EXTENT OF TESTING FACILITIES FOR THE DETERMINATION OF MECHANICAL AND PHYSICAL PROPERTIES OF METALS AT VARIOUS TEMPERATURES. W. P. Achbach. Apr. 30, 1957. 334p. Contract AF18(600)-1375.

Briefly described is the extent of equipment currently available in the U. S. for determination of design strength data for metals. (W.L.H.)

10519 WADC-TR-57-297

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

DESCRIPTIONS OF SOME CURRENT METHODS FOR DETERMINING CREEP PROPERTIES UNDER COMPRESSIVE, BEARING, AND SHEAR TYPE OF LOADING. Period Covered: July 1956 to March 1957. E. L. Horne. Mar. 29, 1957. 30p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. (AD-130802).

The report gives descriptions of several methods currently used for evaluating creep behavior in compressive, bearing, and shear types of loading. Four methods for compressive creep testing are described. Two methods for bearing creep and four methods for shear creep, respectively, are also given. Only unclassified and nonproprietary information is discussed. Special mention is made of methods developed under WADC sponsorship. Future panel action will be based on recommendations by panel members and the organizations they represent resulting from a study of methods described in this report. (auth)

10520 WAPD-PWR-CP-2945

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

OUT-OF-PILE DYNAMIC LOOP TESTS OF IRRADIATED FUEL MATERIALS. L. A. Waldman and W. T. Lindsay, Jr. [Apr. 2, 1957]. 33p. $6.30(ph OTS); $3.00(mf OTS).

Dynamic loop tests were carried out on clad specimens of U–Mo and UO_2 fuel materials which were irradiated and then defected prior to testing. The purpose of these tests was the elucidation of contamination problems. (M.H.R.)

RADIOGRAPHY

10521 WADC-TR-56-440

Technical Operations, Inc., Arlington, Mass.

INVESTIGATION OF ISOTOPES FOR AIRCRAFT RADIOGRAPHY. Period covered: May 15, 1955 to July 31, 1956. Eric T. Clarke. Aug. 1, 1956. 74p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: MEASUREMENTS BY RADIATION. Contract AF-33(616)-3042. (AD-118244).

To determine if isotope radiography will permit inspection of aircraft components, without the need for disassembly, a study was made of the properties of the isotopes Eu^{155}, Ce^{144}, Am^{241}, Ir^{192}, and Tm^{170} in the radiography of light metal structures. On the basis of ease of production, available intensity, and ability to produce sufficient radio-

graphic contrast in typical aircraft materials, the isotopes Ir^{192} and Tm^{170} were selected and their characteristics in stainless steel, titanium, aluminum alloy, and magnesium were measured. Radiographic exposure charts and sensitivity data were established for these materials in conjunction with suitable photographic materials, including lead and fluorescent screens. Data are given on production of these isotopes in nuclear reactors. Results of radiography of actual aircraft are shown which indicate that internal structural detail can be readily made visible, and some types of flaws can be detected, without the need for excessive exposure times. Reproductions of actual radiographs permit comparisons with x-rays. (auth)

10522
RADIOGRAPHY WITH SYNTHETIC RADIOISOTOPES. Hans Herold. Z. angew. Phys. 9, 349-72(1957) July. (In German)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

10523 WADC-TR-57-39
New York. State Univ. Coll. of Ceramics, Alfred.
CERAMIC REINFORCED ALLOYS AND PLATED CERMETS. Period covered: January 30, 1956 to October 31, 1956. M. T. Curran, R. P. Riegert, R. K. Francis, R. S. Truesdale, and J. R. Tinklepaugh. Feb. 15, 1957. 49p. Project title: GAS TURBINE TECHNOLOGY. Task title: CERMET TURBINE BLADING PROGRAM. Contract AF33(616)-2414. (AD-130754).

A precision casting technique was developed for the reinforcement of super alloys with ceramic rods. Procedures were found for the electroplating of cermets with nickel and chromium to improve their impact resistance and for the chemical plating of nickel on titanium carbide grains. The effect of molybdenum as an alloying agent in the cermet binder was observed. (auth)

10524 WADC-TR-57-86
Beryllium Corp., Reading, Penna.
HOT PRESSING OF BERYLLIA ROCKET NOZZLES. Period Covered: July 1956 to January 1957. J. K. Evans and G. D. Kriebel. Jan. 1957. 19p. Project title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-3699.

The effects of time, temperature, pressure, and particle size on the density of hot pressed BeO were investigated. Experimental conditions and densities obtained are tabulated for two types of BeO and their mixtures. A description of the equipment, procedures, and starting materials is included. Photomicrographs of hot pressed BeO of maximum density are shown. The fabrication of rocket nozzles according to the best procedures is described. A limited study of the machining of hot pressed BeO is included. (auth)

10525
EFFECTS OF THE CHEMICAL BOND ON THE FINE LINE STRUCTURE OF K_β GROUP X-RAY EMMISSION SPECTRA IN Ti COMPACTS. E. E. Vainshtein and Yu. N. Vasil'ev. (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 114, 53-6(1956) May 1. (In Russian)

Comparative studies were made of the fine structure of K-line emission from $TiWC_2$, TiC, TiO_2, TiN, and TiH. (R.V.J.)

10526
PROPERTIES OF YTTRIUM OXIDE CERAMICS. C. E. Curtis (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 40, 274-8(1957) Aug.

The cubic structure of yttrium oxide is stable to 1800°C. in air as indicated by petrographic, x-ray, and differential thermal analyses. A change in lattice parameter of less than ± 0.007 a.u. was observed on heating the oxide to 1800°C. The mean specific heat of Y_2O_3 to 1600°C. was 0.13 cal./gm./°C. The coefficient of linear expansion to 1400°C. was 9.3×10^{-6} in./in./°C. Compacts of Y_2O_3 required a temperature of 1800°C. for vitrification. In equimolecular binary mixtures heated in the powdered state at 1500°C., Y_2O_3 formed compounds with Al_2O_3 and Fe_2O_3 and solid solutions with ZrO_2 and HfO_2. Y_2O_3 did not react with CaO, MgO, or ThO_2. Crystal types and unit-cell sizes of the reaction products are included. (auth)

10527
CONSTITUTION DIAGRAMS OF THE $RbF-BeF_2$ AND $BaO-SiO_2$ SYSTEMS. R. G. Grebenshchikov. (Inst. of Silicate Chemistry, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 114, 316-19(1957) May 11. (In Russian)

The "model" systems and their constitution diagrams show that in both systems appear compounds similar in their stoichiometric composition, structure, and smelting congruency. The liquidus in the constitutional diagram of both systems was similar in the interval from RbF to $RbBeF_3$ in fluorine system and BaO to $BaSiO_3$ in silicate system. However, the solid phase equilibrium in the $RbF-BeF_2$ is more complex than in the $BaO-SiO_2$ system. (R.V.J.)

CORROSION

10528 AECU-3529
Case Inst. of Tech., Cleveland.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 16 [for] March 2, 1957 to June 2, 1957. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. June 6, 1957. 3p. Contract AT(11-1)-258. $1.80(ph OTS); $1.80(mf OTS).

Although Zr suffers dimensional instability when scaled between 600 and 1050°C, no growth was observed after scaling of arc-melted Zr in air above 1050°C. Both graphite and arc-melted Zr were scaled in air. The time-temperature relations for breakaway growth and scale color change for these two materials are given. Scaling runs in O_2 at 900°C of the arc-melted and graphite-method Zr show that both materials undergo definite growth. (W.L.H.)

10529 CF-57-4-44
Oak Ridge National Lab., Tenn.
SECOND AND THIRD OPERATING TEST OF HRT CORE VESSEL TRANSITION JOINT AND EXPANSION BELLOWS MOCKUP. R. S. Greeley, W. C. Ulrich, H. C. Savage, J. C. Griess, and T. H. Mauney. Apr. 30, 1957. 39p. Contract [7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Second and third tests were conducted on an expansion bellows and Zircaloy-stainless steel transition joint assembly, duplicating that used in the core-pressure vessel assembly of the HRT. The assembly was exposed for 1140 hours in the second test and 167 hours in the third to a circulation solution containing 0.04m UO_2SO_4, 0.02m H_2SO_4, and 0.005m $CuSO_4$ in a 100A dynamic corrosion loop under conditions simulating reactor startup, shutdown, and steady-state operation. Results indicated that the transition joint assembly as tested was mechanically sound and leak-tight. Pit-type corrosion continued on the expansion bellows where the upper retaining tangent contacts the bellows.

Results are included of specimens exposed to the circulating solution during transition joint and bellows test. (W.L.H.)

10530 CF-57-5-110
Oak Ridge National Lab., Tenn.
IN-REACTOR AUTOCLAVE CORROSION STUDIES – LITR. I. OUTLINE OF METHODS AND PROCEDURES. K. S. Warren and R. J. Davis. May 22, 1957. 45p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

The procedure followed in rocking bomb corrosion experiments made in the LITR is described. The electrically heated bomb, fabricated of the material under test, is filled with the corroding solution and the desired O_2 pressure and placed in the reactor. A rocking motion agitates and causes a flowing of the corrosive U salt solution. The bomb, placement in reactor, and analytical procedures are described. (T.R.H.)

10531 CF-57-6-60
Oak Ridge National Lab., Tenn.
SUMMARY OF CORROSION DATA FOR HRT MOCKUP OPERATIONAL PERIOD ENDING FEBRUARY 16, 1957. R. E. Wacker and J. C. Griess. June 17, 1957. 41p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

During the period of operation a total of 576 hours was completed with 1.30 m UO_2SO_4 at 260°C and 1400 psi pressure with the O_2 concentration ~ 500 ppm. A Ti holder in the suction side of the main circulating line contained coupons of Ti 75A, Zircaloy-2, and types 309 SCb and 347 stainless steel. All coupons contained a heavy, glossy, black paint-like scale. The coupon mounted in the pressurizer heater leg had a rusty film with a trace of yellow precipitate on the bottom of the holder. The corrosion specimen wire mounted in the letdown heat exchanger was removed for examination. (W.L.H.)

10532 CF-57-6-67
Oak Ridge National Lab., Tenn.
EVALUATION OF LOOP COMPONENTS AND ADMIXED THORIUM-3% URANIUM OXIDE SLURRY IN 200A LOOP (SUMMARY OF RUN 200A-10). R. B. Gallaher, A. S. Kitzes, and C. F. VandenBulck. June 13, 1957. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A slurry addition system, a venturi in the circulation loop, and two types of sampling systems were tested with 500 and 800 g Th/kg H_2O slurries in the 200 gpm loop at 250°C and 1000 psig. The addition system worked satisfactorily while the venturi gave erratic readings during part of the run. Both the capillary and in-line sampling systems proved satisfactory with the capillary sampler being much easier and more convenient to operate. The addition of U to the slurry had no appreciable effect on the handling characteristics, the attack rate on 347 SS, the particle size and crystallite size of the ThO_2. The attack rate was found to be 1 mpy during the first 100 hours of circulation and decreased to 0.4 mpy at the end of the run. (auth)

10533 CF-57-6-105
Oak Ridge National Lab., Tenn.
IN-REACTOR AUTOCLAVE CORROSION STUDIES. II. AUTOCLAVE Z-19. K. S. Warren, R. J. Davis, and G. H. Jenks. June 27, 1957. 20p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

In order to test the effect of the molybdate ion on the corrosion of Zircaloy-2, a 0.16 m UO_2SO_4 solution (enriched) containing $CuSO_4$ and 487 ppm of Mo as H_2MoO_4 was autoclaved (bomb Z-19) with rocking at 280 and 300°C for a total of 72 hours in the HB-5 facility of the LITR. The average corrosion rate established by the rate of consumption of oxygen was: 24 mpy at 280°C; power density of 19.0 w/ml and 33 mpy at 300°C; power density of 18.2 w/ml. Virtually all of the Mo originally in solution was found in the ZrO_2 film upon opening the bomb: any efficacy of Mo as a corrosion inhibitor was not demonstrated. No further work with molybdates is contemplated. The penetration by corrosion of two Nb alloys, (85% Zr, 15% Nb, and 83.5% Zr, 15% Nb, 1.5% Sn) present in bomb Z-19 as special test specimens, was observed to be about one-half that of the Zircaloy-2. (auth)

10534 DP-214
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
EROSION OF ALUMINUM. Edward H. Honeycutt, Jr. May 1957. 16p. Contract AT(07-2)-1. $0.20(OTS).

Specimens of aluminum were undamaged or eroded only slightly during two months of exposure to deionized water at velocities up to 125 ft/sec. Flow in a narrow annulus at 125 ft/sec produced no detectable wear on 63S aluminum, but it did produce localized pitting up to 0.01 inch deep on 2S aluminum. Specimens of 2S aluminum were undamaged by water flow at 50 ft/sec through a sharp right-angle bend in a narrow annular channel and through a tube with sudden enlargement and contraction of cross section. (auth)

10535 KAPL-1739
Knolls Atomic Power Lab., Schenectady, N. Y.
CORROSION OF ALUMINUM IN HIGH TEMPERATURE WATER. II. APPLICATION OF INFRARED SPECTRA TO CORROSION STUDIES. R. M. Haag. Feb. 28, 1957. 16p. Contract W-31-109-Eng-52. $0.20(OTS).

The application of infrared transmission measurements to corrosion studies has been investigated. Corrosion products may be identified in situ by reflectance measurements, or after removal from the base metal. Data are included from studies on Al alloys and hydrous Al oxides. (auth)

10536 KAPL-1741
Knolls Atomic Power Lab., Schenectady, N. Y.
CORROSION OF ALUMINUM IN HIGH-TEMPERATURE WATER. III. INHIBITION OF CORROSION BY SODIUM SILICATE. R. M. Haag and F. C. Zyzes. Feb. 28, 1957. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

The corrosion rate of 2-S aluminum in high purity water and in 0.01, 0.1 and 1 wt. % sodium silicate solutions has been measured at 200 and 250°C. A marked inhibition of corrosion was observed in the more concentrated solutions. (auth)

10537 NRL-4711
Naval Research Lab. Washington, D. C.
CORROSION STUDIES IN HIGH-TEMPERATURE WATER BY A HYDROGEN EFFUSION METHOD. M. C. Bloom, M. Krulfeld, W. A. Fraser, and P. N. Vlannes. Feb. 10, 1956. 11p. Project Nos. NS 200-028; NS 200-027; and NR 644-070.

A new method for the measurement of static corrosion rates in aqueous systems at elevated temperature and pressure was developed. Data obtained by application of the method to ferrous systems include the corrosion rate of low-carbon steel in distilled water at 600°F, the effect of raising the pH in such systems, the effect of thermal shock and of temperature rise on the corrosion rate, and the effect of heat treatment of the metal on the corrosion rate. Comparison is made between the corrosion rates of low-carbon steel and stainless steel and some data are included on the effect of the wall thickness of low-carbon steel specimens on the rate of hydrogen effusion resulting from corrosion at 600°F. (auth)

10538 NRL-4929
Naval Research Lab., Washington, D. C.
CORROSION OF METALS IN TROPICAL ENVIRONMENTS.

PART 1. TEST METHODS USED AND RESULTS OBTAINED FOR PURE METALS AND A STRUCTURAL STEEL. A. L. Alexander, B. W. Forgeson, H. W. Hundt, C. R. Southwell, and L. J. Thompson. Apr. 2, 1957. 46p.

An extensive investigation has been in progress since 1940 in the Panama Canal Zone to study the corrosion rates and characteristics of fifty different metals and alloys exposed to five natural tropical environments for periods of one, two, four, eight, and sixteen years. Up to the present, specimens through the eight year period have been removed and examined. The report describes the corrosion rate of Al, Pb, Ni, Zn, and Cu along with structural steel. Corrosion data for these metals as observed in the five environments have been obtained from weight loss and pitting measurements, visual inspection and physical property studies. Furthermore, corrosion rates for these metals in the tropics are related to corrosion rates previously reported for these metals in temperate lattitudes. (auth)

GEOLOGY AND MINERALOGY

10539 RME-2030(Rev.)
Salt Lake Area Office, AEC.
NOTES ON THE RELATIONSHIP OF URANIUM MINERALIZATION AND RHYOLITE IN THE MARYSVALE AREA, UTAH. Ray E. Gilbert. Feb. 1957. 24p. $0.65(OTS).

Uranium deposits of the Marysvale area are in volcanic and plutonic rocks of Tertiary age. The volcanics are divided into the Bullion Canyon volcanics and the younger Mount Belknap rhyolite. They are separated in time by the intrusion of quartz monzonite and related granitic phases. The sequence of geologic events in the Marysvale Central area, following the emplacement of granitic intrusives, was apparently as follows: major displacement along east-trending faults; exposure of intrusives by erosion; then, in close sequence and probably overlapping order, extrusion of red rhyolite agglomerate, fracturing, intrusion of rhyolite dikes, minor north-northwest faulting, intense hydrothermal alteration, and finally, uranium mineralization accompanied by minor alteration. Uranium minerals, including some ore-grade concentrations, are present in red rhyolite agglomerate and in felsitic and glassy rhyolite dikes. Mineralizing solutions were channeled into the agglomerates possibly by shears in underlying quartz monzonite. Dikes were probably mineralized by solutions from great depth that traveled within and along the dikes. Two localities in rhyolite agglomerate have been mined for uranium ore, and additional uranium ore bodies may be present. A plan of prospecting is recommended, starting with detailed surface mapping and radiometric surveying and followed by the use of geophysical and geochemical methods in selected areas. Uranium minerals will be found probably in strongly altered rhyolite, which is likely to be deeply eroded and buried under a thick alluvial cover. (auth)

10540
FRANCEVILLITE, A NEW URANIFEROUS MINERAL. Georges Branche, Marie-Edith Ropert, Francis Chantret, Bernard Morignat, and Robert Pouget. Compt. rend. 245, 89-91(1957) July 1. (In French)

The physical characteristics and chemical composition of a new uraniferous mineral, francevillite, are given. It is a vanadate hydrate of U and Ba found in French Equatorial Africa. Generally, a large part of the Ba is replaced by Pb. (tr-auth)

10541
THE PRESENCE OF AUTUNITE OF RECENT FORMATION IN THE WEATHERED GRANITES OF THE MALLIÉVRE-LES EPESSES (VENDEE). Marcel Roubault and Réne Coppens. Compt. rend. 245, 101-3(1957) July 1. (In French)

Autunite has been discovered in the granitic batholite of Montagne (Vendee); the U is accompanied by a small amount of its descendants. It is of very recent origin. (T.R.H.)

10542
COMPARATIVE STUDY OF ARGON CONTENT AND ARGON DIFFUSION IN MICA AND FELDSPAR. John H. Reynolds (Univ. of California, Berkeley). Geochim. et Cosmochim. Acta 12, 177-84(1957).

The A^{40}/K^{40} ratios for coarse and fine-mesh samples of 100-m.y.-old feldspar (perthitic orthoclase-microline) were compared with those for coarse- and fine-mesh samples of lepidolite from the same pegmatite and found to be in agreement, although there was some evidence for migration of argon from the potash feldspar phase to the soda feldspar phase of the perthite. Fine samples of both minerals were then heated to various temperatures for 48 hours and the radiogenic and atmospheric argon released was measured. At all temperatures below that at which mica is disrupted, leakage from the feldspar was greater. The temperature-dependence of the leakage from the two minerals was found to be quite different. That for the mica suggests that there are two components of argon in the mineral: a minor component which is loosely bound, and a major component tightly bound. The leakage curve for feldspar is quite regular, suggesting that there is only a single argon component. If this is assumed to be so, an extrapolation of the curve provides a lower limit of 10^{-19} cm^2/sec for D, the diffusion coefficient. This value of D is high enough to account for about 35 per cent argon loss in 1-cm grains of 2000-m.y.-old potash feldspar. Atmospheric argon in the minerals appears to be more loosely bound than the radiogenic argon. The A^{40}/K^{40} ratio for samples from the Paia District, California, pegmatite is 0.00525 ± 0.00016, corresponding to an age of 92.0 ± 2.5 m.y. (auth)

10543
COMPARISON OF THE PEBBLES OF THE SHINARUMP AND MOSS BACK MEMBERS OF THE CHINLE FORMATION. Howard F. Albee (U. S. Geological Survey, Grand Junction, Colo.). J. Sediment. Petrol. 27, 135-42(1957) June.

Lithology, color, size, sphericity, and roundness of pebbles from the Shinarump and Moss Back Members of the Chinle Formation were analyzed and compared. The difference in the quartz : quartzite : chert ratios of the pebbles, the presence of limestone and siltstone pebbles, and, to a lesser degree, the difference in color of pebbles serve to distinguish the Moss Back from the Shinarump. In area where the Moss Back and Shinarump are both present, the average ratios of quartz, quartzite, and chert are respectively about 12 : 37 : 51 and 82 : 16 : 2. Limestone and siltstone pebbles are commonly found in the Moss Back, whereas they are rarely found in the Shinarump. The colors of the Moss Back pebbles are generally darker than those of the Shinarump pebbles. The Moss Back contains more gray to black pebbles and few light-colored pebbles, such as red, orange, and white, than the Shinarump. Size, sphericity, and roundness of pebbles do not show a significant difference between the two units. Fossiliferous pebbles in the Moss Back and Shinarump were derived chiefly from sedimentary rocks of Carboniferous and Permian ages and could have had common sources. (auth)

10544
PRELIMINARY GEOLOGIC MAP AND SECTIONS OF THE

WESTERN PART OF THE GATEWAY DISTRICT MESA COUNTY, COLORADO, AND GRAND COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 122. L. J. Eicher, D. C. Hedlund, and G. A. Miller. Washington, U. S. Geological Survey, 1957. $0.50.

10545

PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 1 SE QUADRANGLE MONTROSE COUNTY, COLORADO, AND SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 123. W. D. Carter and J. L. Gualtieri. Washington, U. S. Geological Survey, 1957. $0.50.

10546

PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 1 SW QUADRANGLE SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 124. W. D. Carter and J. L. Gualtieri. Washington, U. S. Geological Survey, 1957. $0.50.

10547

A PRELIMINARY INVESTIGATION OF DIFFERENTIAL GRINDING. GRINDING OF QUARTZ-LIMESTONE MIXTURES. J. A. Holmes and S. W. F. Patching (A.E.R.E., Harwell). Trans. Inst. Chem. Engrs. (London) 35, 111-24 (1957) Apr.

10548

A CONTRIBUTION TO THE STUDY OF COMMINUTION. A MODIFIED FORM OF KICK'S LAW. J. A. Holmes (Atomic Energy Research Establishment, Harwell, Didcot, Berkshire). Trans. Inst. Chem. Engrs. (London) 35, 125-56(1957) Apr.

METALS AND METALLURGY

10549 AD-104272

Case Inst. of Tech., Cleveland.

CALCULATION OF THE ELASTIC SHEAR CONSTANTS OF MAGNESIUM AND MAGNESIUM ALLOYS. Technical Report No. 19. John R. Reitz and Charles S. Smith. July 1956. 28p. Contract N6 ORI 27303.

Leigh's calculation of the elastic shear constants of Al are extended to include crystals of lower symmetry, and the results are used to interpret the constants of pure Mg and dilute Mg alloys. The requirement that pure Mg be in equilibrium with respect to shears that change the c/a ratio of this hexagonal crystal is consistent only with the assumption that electron overlap has already occurred across the Brillouin zone faces perpendicular to the c axis, a result which is at variance with the usual assumptions for this metal. Assuming c overlap and one other type of electron overlap in the pure metal it is found that the total number of overlap electrons (or, equivalently, the number of holes) is 1.70×10^{21} per cm^3, i.e., 2 percent of the valence electron density. The overlap which appears at an electron/atom ratio of 2.01 is assumed to be an overlap in the equatorial plane of Brillouin zone; this overlap produces an abrupt change in one of the shear constants as the electron/atom ratio is increased beyond 2.01, a behavior of the type predicted by Leigh for Al-Zn alloys. The abrupt change in the constant is characteristic T = 0°K, however; at room temperature, the predicted effect is much more gradual and is found to agree with the experimental results. (auth)

10550 AERE-M/R-1638

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE POROSITY AND PERMEABILITY OF HOT COMPACTED COPPER POWDER. G. Arthur. Mar. 14, 1955. Decl. May 9, 1957. 19p.

An investigation was made of the effect of compacting pressure and temperature on the permeability and porosity of hot compacted Cu powder. At a given density, the amount of open and closed pores in the hot compacted material is the same as found in the loose sintered material. The stability of hot compacted specimens on subsequent sintering has also been investigated. Such specimens show larger changes in porosity and permeability than do loose sintered specimens of the same density similarly treated. (W.L.H.)

10551 BM-RI-3722

Bureau of Mines.

INFLAMMABILITY AND EXPLOSIBILITY OF METAL POWDERS. Irving Hartmann, John Nagy, and Hylton R. Brown. Oct. 1943. 45p.

Experiments on the inflammability and explosibility of metal powders are described. Fifty-three powder samples comprising 14 different metals and two alloys were tested. Tests were made on most of the powders to determine minimum ignition temperature and minimum energy needed for ignition of dispersions in air and of quiescent layers, relative inflammability with two different sources of ignition, maximum concentration required in a dispersion in air to permit ignition, maximum pressure and rate of pressure rise in small explosions, reduction in O_2 content of the air needed to prevent ignition, and effect of a humid atmosphere on the powders. (W.L.H.)

10552 CF-57-7-58

Oak Ridge National Lab., Tenn.

PREDICTION OF CREEP FAILURES OF LEAD IN BENDING FROM TENSILE DATA. D. L. Platus and B. Y. Cotton. July 17, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The creep-rupture rates of lead beams in bending tests have been predicted within a factor of 3, based on tensile creep data. (R.V.J.)

10553 HW-49815

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NOTES ON THE FABRICATION OF BASE METAL THERMOCOUPLES. W. F. Hall and D. I. Boget. May 1, 1957. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

. Techniques for gas welding iron-constantan thermocouples are discussed. A good junction was formed with a diameter slightly larger than the diameter of two (20 gage) wires. A design of a simple apparatus for arc welding thermocouples is shown. (R.V.J.)

10554 KAPL-1779

Knolls Atomic Power Lab., Schenectady, N. Y.

PILE-INDUCED THRESHOLD REACTIONS IN STAINLESS STEEL. R. P. Schuman and A. C. Mewherter. May 24, 1957. 8p. Contract W-31-109-Eng-52. $0.20(OTS).

Pure samples of the major components of stainless steel have been irradiated in a receptacle slug in the BNL reactor. Radiochemical separations were made, and the yields of long-lived activities produced by (n,p), (n,2n), and (n,α) reactions were determined. It was found that Co^{58} from $Ni^{58}(n,p)$, Co^{60} from $Ni^{60}(n,p)$, and Mn^{54} from $Fe^{54}(n,p)$ were important activation products with yields comparable to Fe^{59} from $Fe^{58}(n,\gamma)$. (auth)

10555 KAPL-M-EEB-16

Knolls Atomic Power Lab., Schenectady, N. Y.

CYCLIC STRAIN FATIGUE STUDIES ON AISI TYPE 347 STAINLESS STEEL. E. E. Baldwin, G. J. Sokol, and L. F. Coffin. Apr. 19, 1957. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Constant-temperature cyclic-strain fatigue tests are

reported for AISI 347 stainless steel at strain ranges of from 0.0035 to 0.020 in./in. Parameters investigated included temperature (600°C max.), grain size, anisotropy, and influence of sequential loading. Results are interpreted in terms of the plastic strain range—cycles to failure relationship $N^{\frac{1}{2}} \Delta\epsilon_p = c$. (auth)

10556 KAPL-M-RLM-11

Knolls Atomic Power Lab., Schenectady, N. Y.

INTERIM PROGRESS REPORT ON THE CREEP-RUPTURE PROPERTIES OF ZIRCALOY. PART A. EXTRUDED AND ANNEALED ZIRCALOY 3. R. L. Mehan and F. W. Wiesinger. May 29, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Creep-rupture tests of extruded and annealed Zircaloy-3 were performed at 600, 700, and 800°F in a He atmosphere. Curves of rupture strength, minimum creep rate, and ductility values are presented. No evidence was found of any drop in ductility with increasing time under load. Ductility as shown in reduction of area increased with increasing test temperature. (auth)

10557 NACA-TN-3894

Lewis Flight Propulsion Lab., Cleveland.

A STUDY OF THE IMPACT BEHAVIOR OF HIGH-TEMPERATURE MATERIALS. H. B. Probst and Howard T. McHenry. Mar. 1957. 23p.

The impact behavior of titanium carbide base cermets and high-temperature alloys was investigated from room temperature to 1750°F. The effects of amount of binder, binder composition, microstructure, temperature, and stress concentration on the impact strength of cermets are discussed. The NACA drop test was used in order to eliminate "toss energy," and the test variables which affect impact energies measured by the drop test are discussed. (auth)

10558 NACA-TN-3972

California Inst. of Tech., Pasadena.

EFFECT OF FREQUENCY AND TEMPERATURE ON FATIGUE OF METALS. S. R. Valluri. Feb. 1957. 15p.

Phenomenological considerations applied to a standard-linear-solid physical model indicated that for particular temperatures there are corresponding frequencies of fatigue stressing above which the fatigue behavior changes. It is suggested that at room temperature the critical frequency is above that usually encountered in engineering practice. (NACA)

10559 NBL-135

New Brunswick Lab., AEC, N. J.

METALLOGRAPHIC QUALITY STUDIES OF THORIUM METAL. S. J. Broderick and A. J. Busch. Apr. 1957. 39p. $0.30(OTS).

Thorium metal, as cast, arc-melted ingots, and rolled wrought metal, was examined microscopically for inclusion and stringer concentration. Tentative rating methods for metal quality were proposed based on the number and diameter of the inclusion clusters in cast metal. For the wrought material the quality ratings follow the method as proposed for U, namely, the total length of the stringers found over a definite area. Thirty-one photomicrographs of varied inclusion shapes and concentrations are shown for the purpose of acquainting the reader with typical inclusions found in Th metal. (auth)

10560 NMI-1170

Nuclear Metals, Inc., Cambridge, Mass.

ANNUAL PROGRAM REPORT FOR THE PERIOD ENDING JUNE 30, 1956. Feb. 18, 1957. 145p. Contract AT(30-1)-1565. $0.70(OTS).

Studies are discussed which are expected to indicate the nature of radiation damage in metals. These studies are based on the evaporation of atoms from a thin irradiated foil. The metal chosen for study is Ir. Techniques for preparing the irradiation specimen are given. Measurements were made of radiation damage in Cu–Fe alloys which are believed to be characteristic of radiation damage in a class of precipitation hardening alloys. The effects of neutron irradiation were determined on solution-quenched, cold-worked solution-quenched, aged, and aged and cold-worked alloys. The effects of these metallurgical treatments on the alloy's properties prior to irradiation were also measured. An apparatus was developed for studying internal friction in extruded Be. Data from the use of this apparatus are expected to yield information on the effects of impurities and microcracks on ductility. Density, porosity, Q, and permeability values are given for a number of ferrite toroids fabricated from mixtures of MnO, NiO, and MgO with ZnO and Fe_2O_3. Mixing ratios and sintering temperatures are given. None of the ferrites had satisfactory Q values for use in high energy particle accelerators. Results from experimental coextrusions of metallic and non-metallic materials are given which indicate the nature of metal flow in coextrusion processes. The experiments and apparatus are described. The results indicate the ratio of the extrusion constants of the two components may be used to predict the shape and quality of the extruded interface. (D.E.B.)

10561 NP-6360

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM ALLOYS. June 28, 1957. 26p.

A general summary on Ti and Ti alloys, their properties, and their future potentials is given. (L.T.W.)

10562 NRL-4961

Naval Research Lab., Washington, D. C.

AN ANALYSIS OF TEMPERATURE COEFFICIENTS OF SOLUBILITY IN DILUTE LIQUID METAL SOLUTIONS. S. W. Strauss, J. L. White, and B. F. Brown. May 27, 1957. 23p. Project NA 585-001.

Temperature coefficients of solubility taken from the literature were compared with (a) electronegativities of solvent and solute, and (b) relative atomic sizes of solvent and solute, in order to identify the fundamental factor or factors which determine the temperature coefficient of solubility of a solid metal in a second liquid metal. The data were for the following binary solvent: solute systems: Bi: Cr, Fe, Pu, U, and Zr; Cd: Ni; Hg: Ba, Fe, Rb, and Sr; In: U; K: Sb; Mg: Fe, Mn, Ti, and U; Na: Ag, Ca, Cd, Fe, Ni, Pb, Sb, Sn, and Ta; Pb: Fe and W; Sb: U; Sn: La and Te; Tl: Th; and Zn: Ni and U. Graphical multiple correlation indicates that the dominant factor in determining the temperature coefficient is the relative sizes of the solvent and the solute atoms, the coefficient increasing with increasing ratio of radius of solvent atom to radius of solute atom. These results suggest that a strain-energy (or "misfit-energy") factor is operative in liquid metal solutions in a manner similar to that in solid solutions. The effects of electronegativity and of solute concentration in the solid phase in equilibrium with the liquid appear to be small. The systems Na:Fe and Na:Ni are strongly exceptional to the general trend, and it is proposed that in such liquid alloys where the solute atom is much smaller that the solvent atom, a state of aggregation resembling interstitial solution may result. (auth)

10563 ORNL-2328

Oak Ridge National Lab., Tenn.

A CALORIMETRIC INVESTIGATION OF ZIRCONIUM, TITANIUM, AND ZIRCONIUM ALLOYS FROM 60 TO 960°C. J. L. Scott. July 24, 1957. 129p. Contract W-7405-eng-26. $0.65(OTS).

Specific heats and heats of transformation of Zr and Ti metals and their alloys were extrapolated, and the changes

of thermodynamic functions with the additions of solutes were evaluated. The pure metals and alloys studied included iodide Zr, Ti, and alloys of Zr with 0.881 and 5.37 wt. % Ag, 7.77 wt. % In, 17.5 wt. % Nb, 34.4 wt. % Ti, and 300 ppm of hydrogen. Measurements were made in the temperature range of 60 to 960°C. The preparation of the alloys and the design of the calorimeter are described. Experimental data and results are presented in graphic form. (R.V.J.)

10564 SO-2051

General Electric Co. Research Lab., Schenectady, N. Y.
SELF-DIFFUSION IN DILUTE BINARY SOLID SOLUTIONS. III. DIFFUSION IN SILVER–GERMANIUM AND SILVER–THALLIUM SOLUTIONS. R. E. Hoffman. July 1957. 13p. Contract W-31-109-Eng-52. (57-RL-1773). $3.30 (ph OTS); $2.40(mf OTS).

Measurements of diffusivities of Ag in Ag–Tl solutions and of Tl and Ge in pure Ag and their corresponding solutions are reported. A comparison was made of theoretical data and experiments for Ag-rich solutions of Pb, Ge, Tl, and Cu. (R.V.J.)

10565 UCRL-3805

California. Univ., Berkeley. Radiation Lab.
CALCULATION OF THE ThS–U AND ThS–Ti PHASE DIAGRAMS. Leo Brewer. June 1957. 4p. Contract W-7405-eng-48. $0.10(OTS).

The thermodynamic quantities necessary for the calculation of the ThS–Ti and ThS–U phase diagrams are estimated and the phase diagrams calculated. (auth)

10566 WAL-313/48-T5

Syracuse Univ., N. Y. Research Inst.
NEW GRAPHICAL PROCEDURES FOR THE DETERMINATION OF RESIDUAL STRESSES IN PLATES AND THIN-WALLED TUBING. J. M. Sistiaga. Aug. 1956. 27p. DA Project No. 5B93-26-006. Contract DAI-30-115-505-ORD-(P)-613. (MET-345-574T5).

The equations for residual-stress determinations on plates and sheets were modified to permit a comparatively simple and accurate graphical computation of the stresses. Similar equations for the determination of longitudinal and circumferential residual stresses in thin-walled tubings were also developed. To illustrate the procedure, the residual stresses in a Ti plate were determined. (auth)

10567 WAL-313/48-T6

Syracuse Univ., N. Y. Research Inst.
RELATION BETWEEN DIRECT-STRESS AND BENDING FATIGUE OF HIGH-STRENGTH STEELS. G. Scheven and G. Sachs. Sept. 1956. 34p. DA Project No. 5B93-26-006. Contract DAI-30-115-ORD-(P)-613. (MET-345-574T6).

The results of fatigue tests on 4340 steel heat treated to several strength levels and under various conditions of testing are presented. Direct-stress and rotating-bend tests on smooth and notched specimens were performed leading to cycles to failure between a few and about one million. Each S-N curve extrapolates well to the respective static strength as origin. Two characteristic quantities were determined for various cycles, the ratio of the strengths in bending to that in tension (bend-strength ratio) and the ratio of the strengths of notched to smooth specimens (notch-strength ratio). The bend strength ratio for high numbers of cycles is practically equal to one, while for low numbers of cycles it is larger than two for smooth specimens, and between one and two for notched specimens, depending upon their ductility. The notch strength ratio is about 0.3 for high numbers of cycles, above 100,000, and then gradually increases with decreasing number of cycles to the static values, which vary greatly with the steel condition. These are also considerably lower for bending than for tension if the steel is notch sensitive. (auth)

10568 WAL-313/48-T7

Syracuse Univ., N. Y. Research Inst.
EFFECTS OF HYDROGEN ON LOW-CYCLE FATIGUE OF HIGH STRENGTH STEELS. G. Scheven, G. Sachs, and K. Tong. Jan. 1957. 46p. DA Project No. 5B93-26-006. Contract DAI-30-115-505-ORD-(P)-613. (MET-345-574T7).

The results of low-cycle fatigue tests on 4340 steel, heat treated to strength levels between 210,000 and 290,000 psi, are presented. Rotating-bend tests were performed on notched and smooth specimens, in both the as-heat-treated and hydrogen-embrittled conditions. The influence of hydrogen, introduced by cadmium plating, on the fatigue life and crack propagation was investigated, covering a range from approximately 5 to 10,000 cycles. The hydrogen effect was found to be rather inconsistent. However, the fatigue life was usually reduced, particularly if the strength level was 230,000 to 270,000 psi, and if the cycling rate was low. Fracture appearance and crack propagation were greatly influenced by the presence of hydrogen. (auth)

10569 WAPD-FE-1082

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
LABORATORY BEND TESTING OF ZIRCALOY-2. W. L. Frankhouser. Oct. 18, 1955. 31p. $6.30(ph OTS); $3.00 (mf OTS).

Only a slight amount of bending was obtained at room temperature in Zircaloy-2 strip of 0.162 in. thickness before fissuring was observed on the tension bend side of the strip. At 600°F sharp radius bends were possible with similar slow rates of loading. The bend properties of Zircaloy-2 are shown to be anisotropic in respect to the rolling direction. Both heating in vacuum for degassification and cross rolling of the original billet reduce this anisotropy. Of these two, however, only the vacuum treatment improved the longitudinal bend properties which are considered to be critical for subsequent development and production work. The data indicate that the "stringers" in the microstructure are at least partially responsible for the anisotropy of bend properties. Furthermore, additional stringers were opened up in regions of highest strain during bending. The vacuum heat treatment which drastically reduced hydrogen content effectively reduces this tendency. Heating of the strip into the beta region immediately prior to cold working improves the longitudinal bendability of material originally inferior in this respect. (auth)

10570 AEC-tr-2954

HYDROGEN TRANSPORT IN SOLID STEEL DUE TO AN ELECTRIC FIELD. V. I. Yavoiskii (Yavoisky) and D. F. Chernega. Translated from Stal' 16, 790-3(1956). 10p.

10571 AERE-Lib/Trans-728

STRUCTURE OF SUPERCONDUCTORS. IV. X-RAY AND METALLOGRAPHIC INVESTIGATION OF THE SYSTEM BISMUTH–PALLADIUM. N. N. Zhuravlev and G. S. Zhdanov. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 25, 485-90(1953). 10p.

X-ray and metallographic studies were made of the system Bi–Pd, in which the presence of several compounds was established. Super-conductivity is possible in compounds with low symmetry and complex atomic structure. (auth)

10572

INVESTIGATIONS OF K_{β_5} BANDS IN THE X-RAY SPECTRA OF IRON AND CHROMIUM DURING MAGNETIC TRANSFORMATIONS IN Fe–Cr ALLOYS. V. A. Kazantsev (Molotov Rostov on-Don State Univ.). Doklady Akad. Nauk S.S.S.R. 114, 86-7(1957) May 1. (In Russian)

10573

FUNDAMENTALS OF GLASS-TO-METAL BONDING. III. TEMPERATURE AND PRESSURE DEPENDENCE OF WETTABILITY OF METALS BY GLASS. Richard M. Fulrath, Stephan P. Mitoff, and Joseph A. Pask (Univ. of California, Berkeley). J. Am. Ceram. Soc. 40, 269-74 (1957) Aug.

The effects of temperature and pressure on the wettability of metals by glass were studied. A system was completed that was capable of subjecting test combinations to temperatures up to 1400°C. at a working pressure of 10^{-5} mm. of Hg. The variation in wetting with change in pressure and temperature was analyzed by the use of Young's equation primarily for the systems gold–, platinum–, and iron–sodium silicate glass. The interfacial energy for the system gold–sodium silicate glass was calculated to be 1230 dynes per cm. The limitations imposed on the use of Young's equation for analyzing wettability in systems in which an interfacial compound is formed are discussed. (auth)

10574

MAGNESIUM–CADMIUM ALLOYS. VIII. HEAT CAPACITIES OF Mg_3Cd AND $MgCd_3$ BETWEEN 20 AND 290°. THE STANDARD HEATS, FREE ENERGIES AND ENTROPIES OF FORMATION AND THE RESIDUAL ENTROPIES. W. V. Johnston, K. F. Sterrett, R. S. Craig, and W. E. Wallace (Univ. of Pittsburgh). J. Am. Chem. Soc. 79, 3633-7(1957) July 20.

Heat capacities of $MgCd_3$ and Mg_3Cd have been measured between 25 and 270° using a new adiabatic calorimeter permitting a precision of 0.1 to 0.2% in the measurements. Experiments were performed using an intermittent heating technique in order that equilibrium heat capacities might be obtained. The data reveal a specific heat anomaly of the customary type for alloys undergoing order-disorder transitions, with peak values at 83.8 and 150.6° for $MgCd_3$ and Mg_3Cd, respectively. With the aid of the heat capacity data, the standard heats, free energies and entropies of formation of the alloys at 270°, which were reported earlier, have been corrected to 25°. The residual entropy of Mg_3Cd has been found to be 0.03 ± 0.04 e.u./g. atom and the corresponding quantity for $MgCd_3$ has been found to be 0.16 ± 0.04. The latter is in good agreement with the quantity of 0.17 ± 0.01 e.u. computed statistically under the assumption that there is a random distribution of the observed number of Schottky defects over the lattice sites. Attention is directed to the large errors which can occur when the conventional continuous heating technique is used with systems undergoing configurational changes. (auth)

10575

THE HEAT CAPACITIES OF MAGNESIUM AND CADMIUM BETWEEN 20 AND 270°. W. G. Saba, K. F. Sterrett, R. S. Craig, and W. E. Wallace (Univ. of Pittsburgh). J. Am. Chem. Soc. 79, 3637-8(1957) July 20.

Heat capacities of magnesium and cadmium are reported for the temperature interval 20 to 270°. Measurements were made using an adiabatic calorimeter. Results are compared with previous determinations in the same temperature range. Deviations from the accepted values are substantial for magnesium. For cadmium they are smaller but still appreciable. Results are in good agreement with the data obtained at lower temperatures. (auth)

10576

THE PREPARATION OF BERYLLIUM AMALGAM. M. C. Kells, R. B. Holden, and C. I. Whitman (Sylvania-Corning Nuclear Corp., Bayside, N. Y.). J. Am. Chem. Soc. 79, 3925(1957) July 20.

A method for preparing Be amalgam by electrolysis of Be from a $NaCl-BeCl_2$ fused salt mixture into a Hg cathode is described. The properties of Be amalgam are given. (T.R.H.)

10577

DETERMINATION OF THE FERMI SURFACE BY THE DE HAAS-VAN ALPHEN EFFECT. Andre Marchand. J. phys. radium 18, 403-7(1957) June. (In French)

The De Haas—Van Alphen effect is reviewed with stress on its use for the determination of Fermi's surface. The theory of the underlying phenomenon is analyzed, the experimental technique is outlined and the results so far obtained are given. (auth)

10578

NEW MAGNESIUM ALLOYS FOR HIGH TEMPERATURE. T. E. Leontis (Dow Chemical Co., Midland, Mich.). Metal Progress 72, No. 2, 97-103(1957) Aug.

Additions of Th up to 4% (in combination with Zr, Mn, and Zn) produces Mg castings, sheet, and extrusions of superior short-time tensile properties up to 800 or 900°F. This alloy also exhibits better creep resistance up to 700°F and raises the temperature limit of utility as well as extends the range of applications in the 300 to 500°F range. (W.L.H.)

10579

HOW ONE COMPANY AVOIDS ZIRCONIUM PYROPHORICITY HAZARD. Edward W. Krans (Combustion Engineering, Inc., Windsor, Conn.). Nucleonics 15, No. 8, 72(1957) Aug.

10580

METALLURGY OF THE WELDING OF CERTAIN AUSTENITIC HEAT AND CORROSION-RESISTANT ALLOYS. Anthony H. Waterfield (Union Carbide Europa S. A., Geneva) and R. P. Culbertson (Haynes Stellite Co., Kokomo, Ind.). Welding J. (N. Y.) 36, 360s-5s(1957) Aug.

Three corrosion-resistant alloys and three heat-resistant alloys—all highly-alloyed materials—are considered. Their development and uses are touched upon. After a brief description of the methods of preparation for welding, the metallurgical properties of each alloy are considered in turn in the light of their effect on the welding techniques necessary. The fabrication methods for the two types of alloys are discussed in connection with the service to be expected from the alloys. (auth)

10581

Ni–Cr–B BRAZING OF A HIGH-TEMPERATURE ALLOY. George Aggen and Edward E. Reynolds (Allegheny Ludlum Corp., Watervliet, N. Y.) and Roger A. Long (Ferrotherm Co., Cleveland, Ohio). Welding J. (N. Y.) 36, 366s-72s (1957) Aug.

A brazing investigation was conducted on sheet and bar specimens of A-286, an Fe-base precipitation-hardening high-temperature alloy. Brazing was performed in a continuous-belt furnace under a dry H_2 atmosphere. A Ni–Cr–B brazing alloy was used in joining all the specimens. (W.L.H.)

10582

PERMANENT-MOLD CASTING OF THIN, MONOCRYSTALLINE GERMANIUM PLATES. Wolfram Bösenberg. Z. angew. Phys. 9, 347-9(1957) July. (In German)

Refer also to abstracts 10427 and 10750.

TRACER APPLICATIONS

10583

UTILIZATION OF ATOMIC ENERGY IN THE PETROLEUM INDUSTRY. Jacques M. Blum. Industries Atomiques No. 7 and 8, 73-6(1957) June-July. (In French)

How radioisotopes can be used in prospecting, recovery

of petroleum from the earth, and measuring liquid levels in storage tanks are discussed. (T.R.H.)

PHYSICS

10584 ANL-5741
Argonne National Lab., Lemont, Ill.
MASS TRANSFER IN A CONTINUOUS-FLOW MIXING VESSEL. Virgil G. Trice, Jr. July 1957. 43p. Contract W-31-109-eng-38. $0.30(OTS).

Individual continuous-phase film coefficients have been measured on an area basis for the transfer of mass between partially miscible liquids in a continuous-flow mixing vessel. For the systems studied (isobutanol dispersed in water and nitrobenzene dispersed in ethylene glycol) the mass transfer coefficient, in agreement with the penetration theory, was found to vary as the square root of the molecular diffusivity. The applicability of a previously suggested relationship was demonstrated by the correlation of the experimental data in terms of the Sherwood, Schmidt, and Reynolds numbers. The relationship obtained was in fundamental agreement with correlations developed by investigators using other types of liquid-liquid contacting apparatus. (auth)

10585 AERE-M/R-1417
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DIFFUSION OF ARGON IN SILVER (WITH AN APPENDIX ON THE DIFFUSION OF RARE GASES IN URANIUM). A. D. Le Claire and A. H. Rowe. June 24, 1954. Decl. May 1, 1957. 34p.

The diffusion coefficient of argon in silver was determined by annealing samples of silver, charged with argon by bombardment with argon ions in a discharge tube, and measuring the amount of argon released after a known time. For this purpose the argon laden samples were activated in BEPO and the argon released determined with a Geiger Mueller counter. The diffusion coefficient at temperature T is given by $D = 0.12 \exp(-33{,}600/RT)$ cms^2/sec. D is of the same order as the diffusion coefficient of other elements in silver, but slightly larger because of the larger size of the argon atom compared with that of these other elements. In the appendix, a rough estimate is made of the diffusion coefficient of xenon and krypton in uranium. This is employed in a discussion of the feasibility of removing by diffusion the xenon and krypton produced by fission in uranium reactor elements. (auth)

10586 KAPL-1773
Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH INTENSITY GAMMA IRRADIATION FACILITIES AT THE KNOLLS ATOMIC POWER LABORATORY. Samuel S. Jones. Apr. 1, 1957. 36p. Contract W-31-109-Eng-52. $0.30(OTS).

Information is presented concerning the structure, operation, and radiation fields of two high intensity Co^{60} γ irradiation facilities at the Knolls Atomic Power Laboratory. A cylindrical 580-c source is used in a mobile lead-shielded facility. A second source consists of 3440 cs in ten separate capsules. The capsules are mounted in various holes on a plate in a water-shielded facility. The capabilities of the two facilities tend to complement each other. A variety of irradiation studies have been made with these units during the past five years. (auth)

10587 SCTM-220-56(51)
Sandia Corp., Albuquerque, N. Mex.
AN INTRODUCTION TO AERODYNAMIC STABILITY. Paul W. Rowe. Feb. 18, 1957. 151p. Contract AT(29-1)-789. $0.70(OTS).

10588 WADC-TR-56-452
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
DESIGN OF A HIGH-INTENSITY GAMMA IRRADIATION FACILITY. Period Covered: December 1954 through March 1956. Marvin C. Atkins. Aug. 12, 1956. 23p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: EFFECTS OF NUCLEAR RADIATIONS ON MATERIALS AND PROCESSES. (AD-110542).

Construction plans have been prepared for a gamma irradiation facility capable of handling 100,000 c of Co^{60}. In a facility built according to these plans, the radioactive source would be stored in a water well located in a 12 × 12 ft irradiation room. The source would rest on a platform in the well and be lifted up into the irradiation room for all experiments. The facility would be built underground with almost all shielding being provided by the natural earth. Normal laboratory utilities are provided in the plans, with valves and switches located on a control panel in an adjacent building. A closed circuit television system would be installed for viewing of experiments with the source in the operating position. Experimental apparatus would be equipped with suitable instruments so that general purpose manipulators would not be required. Six construction drawings are included in this report. (auth)

10589
PHYSICS OF SUPERHIGH PRESSURES. L. F. Vereshchagin (Moscow Lab. of Superhigh Pressure Physics). Priroda 46, No. 6, 3-8(1957) June. (In Russian)

A review of data on superhigh compression studies is presented, and the dependence of compressed elements on the atomic number order is demonstrated in graphs for elements compressed under 30,000 and 100,000 atm. (R.V.J.)

10590
UTILIZATION OF NUCLEAR EMULSIONS IN THE STUDY OF β RADIATIONS. Georges Marguin. Ann. phys. 2, 318-68(1957) May-June. (In French)

10591
A METHOD OF PRODUCTION OF ENERGETIC PHOTONS OF NARROW SPECTRUM. Christophe Tzara. Compt. rend. 245, 56-9(1957) July 1. (In French)

A practical method for producing monochromatic photons by annihilation of positrons in flight is proposed. An analytical approach to the process showed that the yield and the spectrum were favorable. (tr-auth)

10592
MATRICIAL THEORIES OF THE PHOTON. Tzou Kuo-Hsien. Compt. rend. 245, 141-4(1957) July 8. (In French)

As in the case of the neutrino, there are two theories possible for the photon (electrodynamic maxwellian or matricial formulation): the theory with 6 components and the theory with 3 components. But, contrary to the neutrino case, the photon theories are both invariant with regard to the inversion of space and to time. (tr-auth)

10593
THE LONGITUDINAL ANGULAR DEPENDENCE OF THE PHOTOELECTRIC EFFECT AND ITS INFLUENCE ON THE DETERMINATION OF GAMMA RAY INTENSITIES. Sölve Hultberg and Tihomir Novakov (Nobel Inst. of Physics, Stockholm). Nuclear Phys. 4, 120-4(1957) Aug.

The longitudinal angular distribution of photoelectrons has been measured over the whole angular range ($-\pi \leq \vartheta \leq \pi$) for three different gamma ray energies. A 4 mg/cm^2 U foil was used as converter. From the experi-

mental curves it is possible to obtain relative photoelectric cross sections by integration from $\vartheta = 0$ to $\vartheta = \vartheta_0$, where ϑ_0 is a limiting angle defined by the geometry of the experimental set-up. A comparison of the measured angular distributions has been made with theory showing for certain characteristic quantities an essential agreement. Also, some interesting deviations have been observed. The study of photoelectron lines as a precise method for determining relative gamma ray intensities is discussed. The method has been applied to the decay of Bi^{208} where relative intensities of about 20 gamma rays have been determined with an instrumental resolution of 0.4% at high energies. (auth)

10594

REACTOR-IRRADIATOR FOR MEAT. E. O. Guernsey (Socony Mobil Oil Co., Paulsbora, N. J.) and R. M. Ball (Babcock and Wilcox Co., Lynchburg, Va.). Nucleonics 15, No. 7, 80(1957) July.

A study of beef processing with reactor radiations led to the conclusion that such processing is feasible. Evaluation of a reactor-irradiation system demonstrates the feasibility of a system using a low-temperature reactor, a slab irradiator, and an indium sulfate blanket. The cost of such processing is 1.6 cents/lb but may be reduced to 1.3 cents/lb by continuous operation. (C.H.)

10595

SINCLAIR FACILITY USES SPENT MTR FUEL. Nucleonics 15, No. 7, 108(1957) July.

An industrial gamma irradiation facility is described which uses spent fuel elements from the Materials Testing Reactor as a radiation source. At present four elements that have been aged about 300 days are in use, but shielding and handling facilities are sufficient for up to eight elements aged as little as 20 days after their reactor service. Dose from the elements now in use is 216,000 r/h. Eventually it is planned to use 30-day-cooled elements which will deliver a 2.5×10^6 r/hr, which will be equivalent to approximately 46,000 curies of Co^{60} used in the same geometry. A sketch of the floor plan and a photograph of the radiation cave are included. (C.H.)

Refer also to abstract 10781.

COSMIC RADIATION

10596

ON THE ANALYSIS OF THE SLOW PARTICLES EMITTED FROM COSMIC-RAY STARS. II. Shigeo Nakagawa, Eiji Tamai, Hamiaki Huzita, and Kiyoaki Okudaira (Rikkyo (St. Paul's) Univ., Ikebukuro, Tokyo). J. Phys. Soc. Japan 12, 747-52(1957) July.

Observations have been made on the heavy fragments from stars produced by cosmic-rays and 6.2 Bev protons from the Bevatrons. The charges of the heavy fragments were determined by measuring the width of tracks. The charge distribution of the heavy fragments emitted from Ag or Br nuclei seems approximately to decrease exponentially. The energy distributions of Li and Be nearly agreed with the curves deduced from the evaporation model, assuming the appropriate nuclear temperatures and Coulomb barrier heights. The angular distributions of them were nearly isotropic. According to these results, the process of slow fragment emission seems to be interpreted as that of evaporation. (auth)

10597

INTERPRETATION OF COSMIC RAY JETS OBSERVED IN PHOTOGRAPHIC EMULSIONS. I. A. Ivanovskaya and D. S. Chernavsky (USSR Academy of Sciences, Moscow). Nuclear Phys. 4, 29-38(1957) Aug.

Showers produced in photographic emulsions by high-energy nucleons (10^{10} to 10^{12} ev) — the so-called "jets" — are analyzed. The analysis is based on Fermi's statistical theory extended to the case of interaction between a nucleon and nucleus. It is shown that the main features of these showers can be explained without assuming the existence of two different classes of interactions as has hitherto been done. (auth)

10598

ACCELERATION OF COSMIC-RAY PARTICLES AMONG EXTRAGALACTIC NEBULAE. G. R. Burbidge (California Inst. of Tech., Pasadena). Phys. Rev. 107, 269-71(1957) July 1.

It is proposed that cosmic-ray particles can be accelerated by the Fermi mechanism acting among galaxies in clusters in the same way that Fermi originally proposed for interstellar clouds in our own galaxy. When applied to the local group of galaxies this mechanism does not lead to an appreciable increase in energy over the limit attainable in our own galaxy. However, the conditions in a highly concentrated cluster such as the Coma cluster lead to maximum energies in the range 10^{18}–10^{20} ev. Some implications of these results are discussed. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

10599

CONICAL SPIRAL STRUCTURE AND LAMINAR CLEAVAGE OF GRAPHITE. Takuro Tsuzuku (Tokai Electrode Research Lab., Daigiri, Fujisawa-City, Japan). J. Phys. Soc. Japan 12, 778-88(1957) July.

Apparently circular crystals of graphite prepared from carbon black were investigated by electron microscope. These crystals show circular growth patterns and produce spotty electron diffraction rings accompanied by ellipses and diffuse bands. Moreover, the circular crystal folded in half presents a fan-shaped appearance instead of a semicircular form; i.e., two radii along the folded line makes an angle smaller than 180°. These facts verify that the apparently circular crystal is really a stack of conical graphite sheets, each of which is successively rotated about the common axis in c-direction. It is pointed out that such a conical crystal can be formed by a spiral mechanism. Laminar cleavage of conical crystals was observed, and the gliding mechanism connected with the spiral structure has been explained in terms of dislocations. From the spots distribution on the electron diffraction rings produced by some cleft sheets, the crystal has been concluded to be in the form of polygonal cone. (auth)

10600

THE MAGNETIC STRUCTURE OF Mn_2Sb. M. K. Wilkinson, N. S. Gingrich, and C. G. Shull (Oak Ridge National Lab., Tenn.). Phys. and Chem. of Solids 2, 289-300(1957).

Neutron diffraction investigations on single crystals and powdered samples of Mn_2Sb have determined the magnetic structure of this compound. The ferrimagnetic structure predicted by Guillaud was confirmed except for the exact values of the individual atomic moments of the manganese atoms. Values of $+2.13 \pm 0.20\ \mu_B$ and $-3.87 \pm 0.40\ \mu_B$ were obtained for the magnetic moments of the Mn atoms on the two sublattices from single crystal investigations, and these experimental values satisfactorily explain the scattering from powdered samples at temperatures from 78°K to about 800°K. Results from previous macroscopic magnetic experiments are also consistent with these values of the atomic magnetic moments. (auth)

10601

AN OPTICAL METHOD OF STUDYING THE DIFFRACTION FROM IMPERFECT CRYSTALS. I. MODULATED STRUC-

TURES. B. T. M. Willis (Atomic Energy Research Establishment, Harwell, Berks). Proc. Roy. Soc. (London) A239, 184-91(1957) Feb. 26.

The correspondence between the x-ray diffraction pattern of a crystal and the optical diffraction pattern of a two-dimensional grating has been used to determine the nature of the diffraction from imperfect crystals. A two-dimensional grating representing the structure of the imperfect crystal is prepared on a very fine-grained photographic plate by a technique which gives an error of less than 1 μ in the positions of the elements of the grating. The grating is placed in a bath of cedar-wood oil between optically flat glass plates, and its Fraunhofer diffraction pattern is observed in a modified Lipson diffractometer. Illustrations are given of the application of the optical method to the study of the diffraction from modulated structures, such as alloy Cu_4FeNi_3 with a periodic variation of lattice parameter, and the age-hardening Al-Cu alloy with a variation of both lattice parameter and structure amplitude. (auth)

10602

AN OPTICAL METHOD OF STUDYING THE DIFFRACTION FROM IMPERFECT CRYSTALS. II. CRYSTALS WITH DISLOCATIONS. B. T. M. Willis (Atomic Energy Research Establishment, Harwell, Berks). Proc. Roy. Soc. (London) A239, 192-201(1957) Feb. 26.

Lipson's optical diffractometer has been used to determine the diffraction patterns of gratings representing crystals with dislocations. The optical method lends itself readily to the solution of the two-dimensional problem of diffraction by a single edge dislocation. The intensity distribution near the ideal reciprocal lattice points is, in general, complex, but for certain special points it is relatively simple and in agreement with that deduced by a new theory of Suzuki. An earlier theory of Wilson's fails to explain the observed intensity distribution. Diffuse scattering, not predicted by Suzuki's theory, occurs in the form of streaks joining the reciprocal lattice points. The diffraction has also been studied from gratings consisting of photographs of dislocated bubble rafts, and from a grating whose diffraction pattern is related to that of a screw dislocation. A brief discussion is given of the expected diffraction patterns from crystals with various arrays of dislocations. (auth)

ELECTRICAL DISCHARGE

10603 AEC-tr-2739

ON THE LINE INTENSITY DISTRIBUTION OF SODIUM SUBORDINATE SERIES IN THE POSITIVE COLUMN. V. M. Zakharova and Yu. M. Kagan. Translated from Vestnik Leningrad. Univ., Ser. Mat. Fiz. Khim, 10, No. 2, 125-34(1955). 8p.

Sharp and diffuse sodium series as a function of the discharge parameters were studied in an attempt to observe the case of departure from a Maxwellian electron velocity distribution. The sodium vapor pressure was varied from 1.3×10^{-4} to 1.3×10^{-2} mm. Helium at 3 mm was added to the sodium. The discharge current varied from 10 to 100 ma. (R.V.J.)

10604 AEC-tr-2763

INVESTIGATION OF THE INSTANTANEOUS BRIGHTNESS OF PULSE DISCHARGES IN INERT GASES. K. S. Vul'fson, I. Sh. Libin, and F. A. Charnia. Translated from Izvest. Akad. Nauk S.S.S.R. Ser, Fiz. 19, 61(1955). 4p.

The variation with time of the brightness of pulse discharges in A, Kr, and Xe at different pressures and with pulses of different power was investigated using a mirror scanning technique. The spectral region covered was 380 to 580 mμ. (M.H.R.)

10605 AEC-tr-2765

INVESTIGATION OF HIGH-CURRENT PULSED ARCS. M. E. Britske. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 58(1955). 3p.

10606 AEC-tr-2766

INVESTIGATION OF THE SHAPE AND BREADTH OF SPECTRUM LINES IN DC ARCS. V. F. Kitaeva. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 27(1955). 3p.

10607

EXPERIMENTAL STUDY OF PLASMOIDS. Winston H. Bostick (Univ. of California, Livermore). Phys. Rev. 106, 404-12(1957) May 1.

A plasma source can be used to project ionized matter across a magnetic field. The configuration of plasma observed when an electromagnetic braking action is produced by the presence of low-pressure gas (~1 μ) in the vacuum chamber provides an insight into the manner in which magnetic-field lines can be dragged and twisted. By firing several sources simultaneously, it is possible to simulate in geometrical form the production of spiral galaxies and barred spirals. (auth)

ELECTRONS

10608

STUDY, WITH SPECTROMETER HAVING DOUBLE FOCALIZATION, OF LOW-ENERGY ELECTRONS EMITTED BY RADIOACTIVE MATERIALS. J. B. Bellicard. Ann. phys. 2, 419-70(1957) May-June. (In French)

The special equipment and techniques used made possible the study of backscattering of electrons, the "increasing" L electron group of Th, the "increasing" K electron group of Zn^{65}, and the conversion electrons of Co^{57}. (T.R.H.)

10609

ON THE STRUCTURE OF THE ELECTRON. Georges Jakobi and Nicholas Kolesnikov. Compt. rend. 245, 286-9 (1957) July 17. (In French)

The equivalence is shown, in the static case, of a nonlinear theory of the Born-Infeld type with a linear theory where the electron has a nonpunctual charge. It is shown that a distribution of charge of a single sign is impossible. (tr-auth)

10610

ALLOWED CAPTURE-POSITRON BRANCHING RATIOS. P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 107, 329-30(1957) July 1.

A corrected table of allowed K capture to positron branching ratios is given. The effect of the finite nuclear size on the bound electron wave functions, which was previously ignored, is taken into account. (M.H.R.)

GASES

10611 K-1302(Pt. V)

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE PROBLEM OF KNUDSEN FLOW. PART V. APPLICATION OF THE THEORY OF RADIATIVE TRANSFER. W. C. DeMarcus. July 30, 1957. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The results of a somewhat mechanical translation of some work of Chanrasekhar concerning the diffusion of electromagnetic radiation in stellar atmospheres into the terminology of Knudsen Flow are presented. Explicitly, the problem treated is that of the low pressure flow of a gas through a medium of scattering particles. The scattering is presumed to be a function only of the angle between the incident and scattered directions and there is no

provision for correlation between successive processes. This implies that the results apply only to flow systems with spacing between scattering centers large compared to their linear dimensions. The central result is that the flow resistance, for systems many mean free paths thick, depends only on a single (and simple) moment of the distribution in angle of the scattered paths. This result is applied to several cases previously studied by Lassettre using the classical approximation of Lorentz as formulated for the theory of metallic conductivity. (auth)

10612 AEC-tr-2764
FURTHER RESULTS OF PHOTOELECTRIC INVESTIGATION OF SPARK SPECTRA. S. L. Mandel'shtam and I. P. Tindo. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 60(1955). 3p.

The influence of gas composition and pressure and gap length on the temperature and other characteristics of the gas spectrum was investigated. (D.E.B.)

10613 AEC-tr-2767
SPECTROSCOPIC INVESTIGATION OF HIGH-FREQUENCY DISCHARGES IN GASES AND IN A FLAME ATMOSPHERIC PRESSURE. V. S. Rossikhin and I. L. Tsikora. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 18 (1955). 2p.

INSTRUMENTS

10614 DP-215
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A COLD CATHODE REGISTER. Malcolm H. Goosey. May 1957. 7p. Contract AT(07-2)-1. $0.15(OTS).

A 5-decade register has been developed that uses miniature glow-transfer tubes and cold-cathode trigger tubes. The unit features small size, low power consumption, and good reliability. It can be used in timing and medium-speed counting applications. (auth)

10615 DP-216
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A PRESET COUNTING UNIT USING COLD CATHODE TUBES. Richard T. Nowak. May 1957. 9p. Contract AT(07-2)-1. $0.15(OTS).

A counting unit has been built using cold cathode tubes exclusively. The unit consists of an input amplifier, two Dekatron scaling stages, and a coincidence stage. The input requires a pulse height of at least 1.5 volts for triggering. The unit operates in a preset count manner. The stored count that is necessary to give an output from the preset count feature is adjustable from 1 to 99 counts. The unit was designed for use in a personnel monitor. (auth)

10616 SCDC-666
Sandia Corp., Albuquerque, N. Mex.
ENVIRONMENTAL TESTING OF SOLDERLESS CONNECTORS. J. A. Barber. June 26, 1957. 57p. Contract AT(29-1)-789. (TM-137-57-16). $0.40(OTS).

A test was made to determine the effect of vibration, mechanical shock, thermal shock, humidity, and salt spray on mechanical and electrical characteristics of various types of solderless connectors. (auth)

10617 UNM-TR-EE-1
New Mexico. Univ., Albuquerque.
A TRANSISTORIZED D-C POWER CONVERTER WITH REGULATED OUTPUT (thesis). Roland L. Cooper. Oct. 8, 1956. 94p. [For Sandia Corp. Contract AT-(29-1)-789.] $13.80(ph OTS); $4.80(mf OTS).

10618 AEC-tr-2762
AN ELECTRONICALLY CONTROLLED LOW-VOLTAGE ARC AND SPARK GENERATOR. M. I. Demidov, N. N. Ogurtsova, and I. V. Podmoshenskii. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 72-3(1955). 3p.

A schematic diagram is given of a low-voltage arc and spark generator with electronic control. A circuit developed for measuring and indicating the phase of discharge which can be smoothly varied over the range of 10 to 170° is shown. The phase is set according to a magneto-electric indicator with an accuracy of ~2°. (R.V.J.)

10619
MEASUREMENT OF THICKNESSES IN INDUSTRY BY BETA GAGE. C. Gagne. Industries Atomiques No. 7 and 8, 89-94(1957) June-July. (In French)

The use of radioisotopes in thickness gages in French industry is described. The operation, function, and capabilities of these instruments are discussed. (T.R.H.)

10620
TRANSISTORIZED PHOTOMULTIPLIER HAS 0.1-μsec RESOLUTION. G. S. Brunson (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 7, 86-7(1957) July.

10621
RESISTANCE THERMOMETER FOR NUCLEAR-REACTOR SERVICE. F. Ralph Sias (General Electric Co., West Lynn, Mass.). Nucleonics 15, No. 8, 75-6, 78-80, 82(1957) Aug.

ISOTOPES

10622 ORNL-2315
Oak Ridge National Lab., Tenn.
SOLID SAMPLE MASS SPECTROMETER ANALYSIS OF ENRICHED STABLE ISOTOPES. Joe R. Walton. July 22, 1957. 13p. Contract W-7405-eng-26. $0.20(OTS).

Solid sample mass spectrometer analyses were made on the enriched stable isotopes of 53 elements. The elements analyzed, the compounds used, the oven materials employed, the ions monitored, and some special techniques of analyses are reviewed. (auth)

10623 ORO-164
Arkansas. Univ., Fayetteville.
PREPARATION AND BETA-SPECTRUM OF CARRIER-FREE Ni^{63} AND VERY LOW ENERGY BETA BACKSCATTERING (thesis). Ivor Louis Preiss. May 20, 1957. 51p. Contract [AT(40-1)-277]. $0.35(OTS).

A new radiochemical method is reported for the preparation of appreciable quantities of practically carrier-free Ni^{63} from pile-irradiated Cu by the $Cu^{63}(n,p)$ reaction, which was found to have an effective cross-section of 3.1 ± 0.5 millibarns for the particular neutron spectrum encountered in a typical low intensity training reactor irradiation. The beta spectrum was studied and data are presented. (auth)

10624
PRIMARY EXCITED STATES OF $NEON^{19}$. Roland Barloutaud, Pierre Lehmann, Antoine Levèque, Gérald C. Phillips, and Jacques Quidort. Compt. rend. 245, 422-4(1957) July 22. (In French)

The gamma transitions between the 240- and 280-kev levels and the fundamental in Ne^{19} have been observed. The period of the 240-kev state is 1.8 (± 0.2) × 10^{-8} sec. The order is the inverse of that of the levels of F^{19}. (tr-auth)

10625
COBALT ISOTOPE Co^{60} AS A HIGH ACTIVITY RADIATION SOURCE. W. W. Reichert (Budd Co., Philadelphia). Die Atomwirtschaft 2, 160-2(1957) May. (In German)

10626
NATURAL VARIATIONS IN THE NITROGEN ISOTOPE ABUNDANCE RATIO IN IGNEOUS ROCKS. K. I. Mayne

(Clarendon Lab., Oxford). Geochim. et Cosmochim. Acta 12, 185-9(1957).

A brief preliminary survey of the amount and isotopic composition of the nitrogen found in a range of igneous rocks shows that there is a substantial variation (about a factor of 25) in the yield of nitrogen per gram of rock and that the isotopic composition of the nitrogen varies regularly with the yield within the range of a few per cent. (auth)

10627

ISOTOPIC COMPOSITION OF COMMON LEADS AND CONTINUOUS DIFFERENTIATION OF THE CRUST OF THE EARTH FROM THE MANTLE. Royal R. Marshall (Univ. of Chicago, Ill.). Geochim. et Cosmochim. Acta 12, 225-37(1957).

U^{238}/Pb^{204} and Th^{232}/U^{238} ratios have been calculated from nonanomalous common leads. These values that would be present today in the reservoirs which produced the ores vary systematically with the "model" lead-lead age introduced by Houtermans and his co-workers. The secular trend of the first ratio appears to be due to the addition of lead, primeval in isotopic composition, from the mantle to the crust of the earth. On the basis of a linear rate of addition of lead, relative to uranium, the following conclusions are reached: The rate of addition of lead is 0.09 atom Pb/atom U^{238}/B yr: The U^{238}/Pb^{204} ratio in the crust today is 9.3 ± 0.2. Lead ores would contain more radiogenic component if there were no addition of primeval lead. The isotopic ratios corrected for this effect are more consistent with their evolution through the decay of uranium and thorium in chemically-closed systems. The Th^{232}/U^{238} ratios which would be present today in the lead-ore reservoirs increase linearly with geologic age. Apparently, uranium is being differentiated in respect to thorium at the low rate of 0.01 atom U^{238}/atom Th^{232}/B yr. The Th^{232}/U^{238} ratio in the crust today is 4.1 ± 0.1. (auth)

10628

STUDY OF THE 6.89 Mev LEVEL OF ^{10}B. G. R. Bishop and J. C. Bizot. J. phys. radium 18, 434-40(1957) July. (In French)

Angular distribution and correlation measurements on γ rays emitted from the 6.89 Mev level of B^{10} have been made. They are consistent with spin 1 for this level, but not with spin 2. Interpretation of the forbidden transitions to the levels 2.15 and 0.72 Mev energy by a strong contamination of T = 1 could then not be ruled out. Another forbidden transition (6.89 Mev to 3.58 Mev) has been observed. (auth)

10629

ON THE γ RADIATION EMITTED BY THE RaD → RaE TRANSMUTATION. Marcel Frilley and Manuel Valadares. J. phys. radium 18, 468-73(1957) July. (In French)

Nine lines of conversion electrons of the γ radiation 46.503 ± 0.015 kev from RaD have been observed by means of a 180° magnetic spectrograph with pre-acceleration. Their relative intensities have been determined. These results have been compared to those given by the most recent theoretical calculations dealing with internal conversion. In addition some crystalline diffraction spectra of γ rays and of L-photons have been obtained. (auth)

Refer also to abstract 10469.

MASS SPECTROGRAPHY

10630 AERE-GP/M-194

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN IMPROVED METHOD OF PRODUCING TRIPLE FILAMENT BEADS FOR USE IN THE MASS SPECTROMETER TYPE MS. 5 ION SOURCE. S. W. Osborne. Oct. 23, 1956. Decl. May 23, 1957. 10p.

MATHEMATICS

10631 AECU-3458

Oak Ridge Gaseous Diffusion Plant, Tenn.

STATISTICS FOR ENGINEERS. C. Daniel. 1947. 90p. Contract W-7405-eng-26. $0.50(OTS).

Many sources of information are used in forming estimates of the behavior of engineering equipment. Physical and chemical theory, laboratory data, engineering tests, pilot-plant experiments, and plant experience in varying proportions are all regularly used. The purpose of the estimates may be to improve plant operation, to design new equipment, to develop a new process, or to provide a meaningful summary of past performance. The notes which follow are presented in the belief that more information can be obtained from engineering data than is usually thought possible. The statistical methods proposed are also instructive in that they indicate improved methods of arranging tests and experiments that will in many cases, provide more reliable information on the points under discussion. (auth)

10632 AECU-3534

Sandia Corp. Albuquerque, N. Mex.

DISTRIBUTION-FREE TOLERANCE LIMITS. D. B. Owen. June 24, 1957. 17p. Contract AT(29-1)-789. (TM-66A-57-51). $3.30(ph OTS); $2.40(mf OTS).

This memorandum supersedes AECU-3451 dated Mar. 28, 1957.

A method is reviewed for setting a limit such that the probability is α that at least the proportion β of future observations will be greater than (or less than) this limit. The method has great generality because no assumptions except continuity are necessary as to the form of the underlying distribution. The method may be used to establish reliability of a component when sufficient numbers of the component are measured. (auth)

10633 ANL-5739

Argonne National Lab., Lemont, Ill.

TABLES OF CHARGED PARTICLE PENETRABILITIES. J. P. Schiffer. June 1957. 60p. Contract W-31-109-eng-38. $0.40(OTS).

Coulomb functions A_l^2 were calculated over a limited range of parameters on an IBM 650 computer in order to analyze recent experimental results. Results are tabulated. (M.H.R.)

10634 APAE-Memo-88

Alco Products, Inc., Schenectady, N. Y.

TWO-GROUP MULTIREGION AXIAL WINDOW-SHADE CALCULATION ON THE IBM 650. F. B. Fairbanks. Mar. 29, 1957. 43p. Contract AT(11-1)-318. $7.80(ph OTS); $3.30(mf OTS).

A nine-region, two-group finite difference calculation in slab geometry for the basic IBM 650 with a 2000 word storage capacity and one Type 533 unit is coded. The code solves the steady-state two-group equation with fast and thermal fission. A perpendicular buckling must be specified. Also included is the addition of a uniform thermal poison to one section of a reactor to represent the effect of control rods. The program may optionally adjust the insertion of the poison to achieve approximate criticality. (auth)

10635 BRL-1010

Ballistic Research Labs., Aberdeen Proving Ground, Md.

A SECOND SURVEY OF DOMESTIC ELECTRONIC DIGI-

TAL COMPUTING SYSTEMS. Martin H. Weik. June 1957. 453p. DA Project No. 5B0306002.

Supersedes BRL-971.

Based on the results of a survey, the engineering and programming characteristics of one hundred and three different electronic digital computing systems are given. The data are presented from the point of view of application, numerical and arithmetic characteristics, input, output and storage systems, construction and checking features, power, space, weight and personnel requirements, production records, cost and rental rates, sale and lease policy, reliability and operating experience, engineering modifications and improvements and other related topics. An analysis of the survey data, fifteen comparative tables, a discussion of trends, a bibliography, and a complete glossary of computer engineering and programming terminology are included. (auth)

10636 KAPL-M-WBL-1

Knolls Atomic Power Lab., Schenectady, N. Y.

USE OF IBM 650 IN REDUCTION OF FOIL COUNTING DATA. W. B. Leng and A. L. Dodson. Apr. 16, 1957. 45p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

(Replaces KAPL-M-EBF-6).

Operating procedures are presented for the processing of data obtained in foil activation experiments using the IBM 650 digital computer. This system furnishes counting information directly on punched cards. The method provides great simplification of calculations and the consequent rapid availability of experimental data for analysis. Seven programs are included. (C.H.)

10637 MURA-319

Midwestern Universities Research Assn., Madison, Wisc.

RESONANCES OF CERTAIN HILL EQUATIONS. R. E. Mills. July 5, 1957. 22p. Contract AT(11-1)-384. $4.80 (ph OTS); $2.70(mf OTS).

The MURA IBM 704 computer was used to study the properties of certain resonances of Hill Equations. The equations studied were those obtained by Laslett and Sessler as an approximation to the axial motion in spiral-ridged FFAG accelerators. It is found that the theoretical treatment of L and S provides a reasonably good approximation to the resonances of the Hill Equations. (auth)

10638 MURA-329

Midwestern Universities Research Assn., Madison, Wis.

THE FORM OF SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS WHOSE COEFFICIENTS ARE MULTIPLY-PERIODIC SERIES. A. F. Stevenson. Aug. 1, 1957. Contract AT(11-1)-384. $1.80(ph OTS); $1.80(mf OTS).

10639 WAPD-A1W(P)-82 and Add.

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

TABLE OF Γ (τ). O. F. Swift. Mar. 1956. 44p. Addendum: May 1956. 12p. Contract AT-11-1-GEN-14. $9.30(ph OTS); $3.60(mf OTS).

Γ (τ), used in the inhour formula for computing reactivity, has been evaluated for approximately 2000 values of τ and six groups of delayed neutrons. The results are presented in tabular form. In addition to the table of Γ (τ), values of Γ calculated for τ in the range 15.0 to 59.9 sec, in increments of 0.1 sec, are included. (auth)

10640 WAPD-TM-53

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CANDLE — A ONE-DIMENSIONAL FEW-GROUP DEPLETION CODE FOR THE IBM-704. O. J. Marlowe and P. A. Ombrellaro. May 1957. 86p. Contract AT-11-1-GEN-14. $13.80(ph OTS); $4.80(mf OTS).

A one-dimensional, few-group depletion code designed for the study of slab, cylindrical, and spherical reactors is described. Such a code is of use in estimating reactor lifetimes for given fuel loadings and in determining the time dependence of fuel distributions and flux shapes. Criticality is maintained during lifetime either by the use of a variable poison cross section, Σ_p, or a variable transverse buckling. This buckling is presumably related to the effective height of the reactor for a given rod bank position. To permit treatment of axial depletion in slabs and cylinders, provisions have been made for controlling reactivity by moving the interface between a poisoned (rodded) and an unpoisoned (unrodded) region. Group constants are computed from effective one-velocity microscopic cross sections. The fast group microscopic cross sections are stored on a library tape, whereas the thermal microscopic cross sections are supplied as input data for each problem. Other input data required are the initial isotopic number densities, thermal self-shielding factors, and group-dependent resonance escape probabilities for U^{238}. New isotopic number densities are then automatically recomputed at each time step. (auth)

10641 WAPD-TM-59

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE CALCULATION OF THERMAL STRESS IN CYLINDERS WITH INTERNAL HEAT GENERATION: DESCRIPTION OF WBSTG1 CODE. Duane M. Davis and Benjamin H. Mount. May 17, 1957. 39p. Contract NObs-67500.

The WBTSG1 code is intended to calculate the stress from the accurate temperature distribution for a cylinder and present the results in nondimensional form that may be used directly for design purposes. The code can also be used to compute stress distribution for a single diameter ratio. By means of this program, thermal stress is calculated for four cases: equal temperatures on both surfaces, insulated inside wall, insulated outside wall, and equal bulk (water) temperatures on both sides. (auth)

10642 AEC-tr-2855

THE STATISTICAL THEORY OF PHASE TRANSITIONS. (Statisticheskaya Teoriya Fazovykh Prevrashcheny). B. T. Geilikman. Translated from a publication of the State Technico-Theoretical Literature Press, Moscow, 1954. 77p. $0.45(OTS).

The statistical theory of phase transformations of the first and second order based on the studies of the general expression for the sum-over-states for a system of interacting particles is presented. The conditions necessary for transitions from one state to another and the mechanism of the transitions are discussed. The general results of the theory were confirmed by several examples for quantum and classical systems. (R.V.J.)

10643

SECOND RANK SPINORS WITH INVARIANT COMPONENTS AND SPINOR FORMALISM INCLUDING PARITY. J. Winogradzki. J. phys. radium 18, 387-94(1957) June. (In French)

Determination is made of all the second rank Dirac spinors whose components are invariant under the following groups: group of the inversions $x^k = \pm x'^k$, orthochronous proper Lorentz group, general Lorentz group. It is shown that the knowledge of these spinors leads to a more satisfactory formalism than the usual one. (auth)

10644

ALGEBRAIC TABLE OF VECTOR-ADDITION COEFFICIENTS FOR $j_2 = \frac{1}{2}$. M. A. Melvin and N. V. V. J. Swamy (Florida State Univ., Tallahassee). Phys. Rev. 107, 186-9 (1957) July 1.

Vector-addition coefficients are given by a terminating hypergeometric sum of the ${}_3F_2$ type, which is easily converted to a simplified form. This form is equivalent to those found independently by Gaunt, van der Waerden, and

Racah. It is used to fill the gap for $j_2 = 5/2$ in the literature of published algebraic tables. (auth)

10645
THE MATHEMATICAL THEORY OF SAMPLING. Walter A. Hendricks. New Brunswick, The Scarecrow Press, 1956. 370p.

MEASURING INSTRUMENTS AND TECHNIQUES

10646 AF-SAM-57-86
School of Aviation Medicine, Randolph AFB, Texas.
CHEMICAL SYSTEMS FOR THE MEASUREMENT OF PENETRATING RADIATIONS. Techniques and Production. Sanford C. Sigoloff. May 1957. 40p.

Techniques are presented for the production of chlorinated hydrocarbon dosimeter systems. Included are instructions for evaluation and a discussion of the ranges and properties of each system. (C.H.)

10647 AF-SAM-57-102
School of Aviation Medicine, Randolph AFB, Texas.
CONVERSION OF CARBON-14 SAMPLES TO BENZOIC ACID FOR COUNTING IN A LIQUID SCINTILLATION COUNTER. Robert M. Dowben. Mar. 6, 1957. 3p.

A method of preparing carbon dioxide–C^{14} samples for liquid scintillation counting is described. By this method, the samples are converted to benzoic acid by carbonation of phenyl-Grignard reagent. (auth)

10648 HW-49718
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DEVELOPMENT OF A COINCIDENCE SPECTROMETER AND A METHOD FOR ANALYSIS OF COBALT-60. H. R. Helmholz. Apr. 22, 1957. 67p. Contract W-31-109-Eng-52. $0.40(OTS).

A specific instrumental method is described for the determination of Co^{60} in fission product waste streams. A combination of coincidence counting and energy discrimination is used to selectively determine only the high-energy photons arising in the decay of Co^{60}. The procedure requires a minimum of chemical separation, and is limited only by the total activity of the accompanying radionuclides. The counting efficiency for Co^{60}, defined as the coincidence counts per disintegration, is about 0.3 per cent. It is possible to determine 1000 disintegrations per minute to an accuracy within ± 6% in the presence of 10^5 pulses per minute arising in the detector due to impurities having either lower energy coincidences or higher energy, single photons. The equipment required for the cobalt analysis has been expanded to include a coincidence spectrometer. The various components comprising the instrument are described, and an evaluation is made of the choice of instrument and detector parameters. For the particular type of amplifier and photomultiplier which have been chosen, the practical limit in the random pulse rate which may be tolerated in coincidence counting is shown to be approximately 10^5 pulses per minute. The possible application of this instrument to other special analytical procedures is discussed. The coincidence system is especially suited to the study of decay schemes and to the standardization of certain radionuclides. It is possible to use the instrument for pulse height analysis, and it may be readily converted to a low resolution, nuclear spectrometer, the application depending upon the choice of detector system. (auth)

10649 R-57GL181
General Electric Co. General Engineering Lab., Schenectady, N. Y.
SOME CALCULATIONS PERTAINING TO THE EXPECTED OPERATIONAL CHARACTERISTICS OF A SMALL IONIZATION CHAMBER FOR S. A. R. E. E. Goodale and D. H. Morley. May 14, 1957. 36p. $6.30(ph OTS); $3.00(mf OTS).

In the course of developing a small ionization chamber to detect boiling in a reactor core, a number of calculations were made having to do with the operational characteristics of such a device. Results are presented from calculations on maximum chamber size, the lifetime of boron at 10^{14} nv, an analysis of induced activity, neutron induced currents in the chamber, γ response of the chamber, saturation point, and heating of the chamber. (C.H.)

10650 USNRDL-TR-147
Naval Radiological Defense Lab., San Francisco.
4-PI GAMMA IONIZATION CHAMBER DECAY MEASUREMENTS OF FALLOUT SAMPLES FROM OPERATION CASTLE. W. H. Shipman and J. R. Lai. Jan. 13, 1956. 20p. Project NS 088-001.

Certain fallout samples from Operation CASTLE were retained for decay rate measurement. The exponent of the equation $A_t = A_o t^{-k}$ was evaluated from appropriate log-log plots and found to be in the range 1.1 to 2.03. This range of values is larger than that expected from thermal-neutron fission. (auth)

10651 WADC-TR-56-657
Wright Air Development Center, Wright-Patterson AFB, Ohio.
THEORETICAL ANALYSIS OF THE RESPONSE OF A PROTON RECOIL TYPE NEUTRON DETECTOR. Sven R. Hartmann. Dec. 20, 1956. 54p. Project 6002. (AD-118272).

A calculation is made to determine the number of recoil protons produced per unit area, by a neutron flux of arbitrary energy, in an infinite hydrogenous slab which reaches but does not pass through an infinite detector slab located immediately behind a hydrogenous slab. A general case is considered for an isotropic neutron flux incident upon the above system in which an arbitrary thickness of some proton absorbing material separates the hydrogenous and detector slabs. A discussion of the results is given indicating how one can control the energy and the energy interval over which the system is sensitive to neutrons. A final calculation is made to determine the response of the system to a collimated neutron flux for an arbitrary orientation of the hydrogenous-detector system. This is done so that the effect of a nonisotropic flux can be determined. (auth)

10652 AEC-tr-2948
A SIMPLE RADIATION DETECTOR. L. Ya. Davidchuk and K. V. Chmutov. Translated from Zhur. Fiz. Khim. 30, 2807(1956). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 11: 3967.

10653
WELL-BOTTOM CONTAINER IMPROVES GAMMA COUNTING. Arthur F. Dratz (Veterans Administration Hospital, Atlanta, Ga.). Nucleonics 15, No. 8, 83-5(1957) Aug.

10654
PHANTOM MEASUREMENTS WITH THE MICROIONIZATION CHAMBER OF THE BOMKE DOSIMETER COMPARED WITH MEASUREMENTS OF RADIUM AND COBALT^{60}. Albrecht Reub and Franz Brunner. Strahlentherapie 103, 279-88(1957). (In German)

10655
COUNTING BY SCINTILLATIONS. Henry Durand. Industries Atomiques No. 7 and 8, 77-82(1957) June-July. (In French)

The development, operating principles, types, and ad-

vantages of scintillation counting and counters are discussed. (T.R.H.)

10656

RECENT PROGRESS IN THE STUDY AND FABRICATION OF PHOTOMULTIPLIER TUBES. D. Gensollen. Industries Atomiques No. 7 and 8, 83-7(1957) June-July. (In French)

The fundamental principles of photomultiplier tubes are discussed, and the 51 AVP is described in detail. (T.R.H.)

10657

A FAST COINCIDENCE CIRCUIT WITH TIME-SORTER. Ernst Remy and Klaus Winter. J. phys. radium 18, Suppl., 112A-15A(1957) July. (In French)

A fast coincidence circuit and time-sorter will be described, designed for time-of-flight measurements of fast neutrons. The inherent time resolution of the electronic is 3×10^{-10} s. The full width a half maximum of the ^{22}Na time resolution curve is 1.5×10^{-9} s. The dependence of pulse height at the output of the time sorter from time difference of input pulses is linear in the region of 2 to 16 mμ s. (auth)

10658

AN APPARATUS FOR PROTECTIVE CONTROL AGAINST γ RADIATION. V. A. Petrov (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 2, 85(1957) May-June. (In Russian)

10659

GAMMA-RAY STREAMING THROUGH A DUCT. David G. Chappell (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 15, No. 7, 65(1957) July.

A formula is presented for use in the rapid determination of the geometrical attenuation of the γ flux streaming through a cylindrical duct from an emitting surface upon which the duct abuts perpendicularly. (C.H.)

10660

LARGE-SENSITIVE-AREA PORTABLE ALPHA MONITOR. F. D. Ryder and H. V. Hardison (E. I. du Pont de Nemours & Co., Aiken, S. C.). Nucleonics 15, No. 7, 82(1957) July.

A portable α scintillation monitor is described which provides a large sensitive area, compactness, and light weight. A circuit diagram is included. (C.H.)

10661

SIMPLE RECORDING GAMMA-RAY SPECTROMETER. William H. Veneable, Jr. (Univ. of Florida, Gainesville). Nucleonics 15, No. 7, 84-6(1957) July.

10662

RAPID METHOD FOR DATING NUCLEAR EXPLOSIONS. Sait Akpinar (Univ. of Istanbul, Turkey). Nucleonics 15, No. 7, 88-9(1957) July.

The continuous change in β-ray energy distribution as manifested in β-absorption curves of fall-out products was applied in a rapid method for dating nuclear explosions. (C.H.)

10663

WAFER SCANNER LOCATES U^{235} BURNUP IN FUEL. Nucleonics 15, No. 8, 74(1957) Aug.

Refer also to abstract 10423.

MESONS

10664 UCRL-3802

California. Univ., Berkeley. Radiation Lab.

A HIGH-VELOCITY POINT ON THE RANGE-ENERGY CURVE FOR EMULSION. Renée B. Feldman. June 4, 1957. 7p. Contract W-7405-eng-48. $0.15(OTS).

Range measurements were made in Ilford G.5 emulsion exposed to a magnetically separated beam of positive K mesons accompanied by pions of the same momentum, 360 Mev/c. The pions had a velocity v = 0.92c. Five π-meson tracks, each ~34 cm in length, were measured. The momentum of each particle was also determined. The results were then compared with the Barkas range-energy curve and found to be 0.5 ± 1.0% higher. (auth)

10665

A POSSIBLE TEST OF THE PRIMARITY OF THE WEAK INTERACTIONS COMPRISING LEPTONS. S. Oneda (Univ. of Manchester). Nuclear Phys. 4, 21-8(1957) Aug.

A careful analysis of the charge properties of the secondary particles in the K-meson decays comprising leptons is proposed. The occurrence of the modes $K^+ \rightarrow \pi^+ + \pi^+ + \mu^-(e^-) + \nu$ and $K^0 \rightarrow \pi^+ + \mu^-(e^-) + \nu$ should give good information on the character of the primary weak interactions. Also the importance of the investigation of the alternative decays of hyperons into leptons is stressed. (auth)

10666

PRODUCTION OF NEUTRAL π-MESONS BY HIGH ENERGY PROTONS. Yu. D. Bayukov, M. S. Kozodayev, Yu. D. Prokoshkin, and A. A. Tyapkin (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Nuclear Phys. 4, 61-87(1957) Aug.

Neutral π mesons are created on complex nuclei in collisions of incident proton with separate nucleons in the nucleus but not with the nucleus as a whole. At a proton energy of 470 Mev the π^0 mesons produced on a complex nucleus are mainly emitted at small angles with respect to the direction of collision of the nucleons. A term proportional to $\cos^2 \theta$ plays a significant role in the angular distribution of π^0 mesons. No difference in the energy spectra of γ quanta created on light and heavy elements was found. Identity of the spectra can be considered established only for high-energy γ quanta. With the rise of the proton energy to 660 Mev the increase of the cross section for π^0 meson production in collisions of two protons substantially slows down in comparison with the rapid increase of this cross section observed in the energy region lying below 470 Mev. π^0 mesons are mostly produced on the surface of complex nuclei bombarded by 660-Mev protons. This effect for heavy and average nuclei can be explained by meson absorption and proton scattering in the nucleus. The angular distribution of γ quanta produced in π^0 meson decay greatly depends on the mass number of the incident nucleus. With increase of mass number the angular distribution of γ quanta becomes more isotropic in the c.m. system. For protons this effect can be partly explained by nuclear screening in the presence of strong meson absorption and, to a less extent, by meson scattering in the nuclei. From the dependence of the angular distribution of γ quanta on mass number it can be inferred that the energy of spectra of γ quanta from the decay of π^0 mesons produced on light and heavy elements should considerably differ in the low energy region of γ quanta. The γ spectrum for 660-Mev protons is only slightly shifted towards high energies with respect to the spectrum from 470-Mev protons. This can be explained by a decrease in the number of π^0 mesons which are produced with energies near to the maximum possible value. The anisotropy if the π^0 meson angular distribution in the center of mass system of the colliding nucleons is lower at 660 Mev than at 470 Mev. (auth)

10667

POLARISATION OF μ-MESONS AND ELECTRONS IN K-MESON DECAYS. J. Werle (Univ. of Manchester). Nuclear Phys. 4, 171-82(1957) Aug.

The longitudinal polarization of the μ mesons and electrons emitted in $K \rightarrow \pi + \nu + \mu$ (or e) is investigated under the assumption that the neutrino is completely polarized

in the direction parallel to its direction of motion. The general form of the S matrix containing four coupling types is taken into account. It turns out that the polarization as a function of the energy depends in a very sensitive way on the type of coupling. This may provide a new powerful tool for the investigation of the form of coupling. (auth)

10668

CAPTURE OF NEGATIVE K PARTICLES BY BOUND AND FREE PROTONS IN EMULSION. Francis C. Gilbert, Charles E. Violet, and R. Stephen White (Univ. of California, Livermore). Phys. Rev. 107, 228-38(1957) July 1.

Data are presented from the captures of negative K particles by bound and free protons in nuclear emulsion. Only those captures in which a charged π meson and one additional charged particle are emitted are included in the study. A model is presented for K^--particle capture on bound protons in which the external energies of the emitted Σ hyperons and π mesons are modified from the values for captures on free protons by the internal proton momenta and the Coulomb and nuclear potentials. The model is used to explain the observed Σ^+- and Σ^--hyperon and π^-- and π^+-meson energy distributions. A Coulomb potential of 10 ± 3 Mev is estimated from the relative positions of the high-energy ends of the Σ^+- and Σ^--hyperon energy distributions. This value suggests that most of these captures were on the heavy elements of the emulsion. This potential reduces the ratio of Σ^- to Σ^+ hyperons, which escape the nucleus, from the value of 2 measured on free protons to the value 0.83 ± 0.25 for protons bound in emulsion nuclei. The sum of the binding energies of the last proton in the capture nucleus and the excitation energy of the residual nucleus has a distribution which is peaked at about 20 Mev. Conservation of energy and charge are applied to the identification of the Σ hyperons that end without making a visible star. The prong distribution for stars made by Σ^+-hyperon captures in emulsion nuclei can be interpreted as a composite of two distributions: one, a line spectrum of zero-prong events, when the Λ^0 or Σ^0 hyperon and neutron escape; the other, a spectrum of many-prong events, when the Λ^0 or Σ^0 hyperon or neutron (or both) are absorbed. The number of Σ^- hyperons that were captured to give stars of zero or one prong is 0.65 ± 0.10. Seven Σ^+ hyperons that decayed into protons at rest are used to find a Σ^+-hyperon mass of $2329.5 \pm 1.0\ m_e$. Two examples of K^- captures on free protons in the emulsion give Σ^- hyperon masses of $2347.4 \pm 3.5\ m_e$ and $2341.8 \pm 1.5\ m_e$. (auth)

10669

OPTICAL MODEL FOR PRODUCTION OF Σ PARTICLES IN NUCLEI BY NEGATIVE K MESONS. Richard H. Capps (Univ. of California, Berkeley). Phys. Rev. 107, 239-48 (1957) July 1.

The experimental data of Gilbert, Violet, and White, concerning the charged Σ particles emitted when negative K particles are stopped in photographic emulsions, are interpreted by means of an optical model. It is assumed that the primary absorption interaction involves directly only a single nucleon, and that the impulse approximation is valid in this interaction. The observed spectra of Σ^+ and Σ^- particles emitted in two-prong stars indicate that the charge-independent part of the Σ-particle nuclear potential in the model must be attractive. From a comparison of the emulsion data with the results of stopping K^- particles in a hydrogen bubble chamber, limits are placed on the possible size of the cross section in nuclei for the absorption of charged Σ particles by means of conversion to neutral Σ or Λ particles. (auth)

10670

CHARGED Σ HYPERONS FROM 1001 K^- MESON STARS. W. F. Fry, J. Schneps, G. A. Snow, M. S. Swami, and D. C. Wold (Univ. of Wisconsin, Madison). Phys. Rev. 107, 257-69(1957) July 1.

1001 K^--meson stars were found by area-scanning in four successive stacks of emulsion pellicles exposed to momentum-analyzed negative channels at the Berkeley Bevatron. Systematic following of the prongs showed that there emerged from these stars 319 charged π mesons, 46 hyperfragments, and 158 identified charged hyperons. There were 26 $\Sigma^+ \rightarrow p + \pi^0$ decays at rest; 20 $\Sigma^+ \rightarrow \pi^+ + n$ decays at rest; 14 $\Sigma^+ \rightarrow p + \pi^0$ decays in flight; 26 $\Sigma^+ \rightarrow \pi^+ + n$ decays in flight; 50 Σ^- stars at rest, and 22 Σ^- zero-prong stars with Auger electrons. The branching ratio of the Σ^+ hyperon is found to be $R = (\Sigma^+ \rightarrow p)/(\Sigma^+ \rightarrow \pi^+) = 1.18 \pm 0.32$. The best single value for the Σ^+ lifetime, as determined from all $\Sigma^+ \rightarrow p$ decays, is $(0.96_{-0.21}^{+0.37}) \times 10^{-10}$ sec. For the Σ^- hyperons, a lifetime of $(2.5 \pm 0.8) \times 10^{-10}$ sec is deduced. However, the lifetime obtained from the mixture of $\Sigma^\pm \rightarrow \pi^\pm + n$ decays in flight alone is $(0.32_{-0.07}^{+0.11}) \times 10^{-10}$ sec. The angular distribution of $\theta_{\Sigma\pi}$, the angle between the decay π meson in the Σ rest system and the initial direction of motion of the Σ, was determined from 85 Σ decay events. Of these, 50 events have $|\cos\theta_{\Sigma\pi}| > 0.5$, and 53 events have $\theta_{\Sigma\pi} > 90°$. Hence this sample of data suggests, but does not prove, that the spin of the Σ is greater than $\frac{1}{2}$ and that there is parity-doubling for each Σ. Other topics are presented, including the energy distribution of the Σ hyperons, an analysis of stars produced by Σ^- hyperons, and the apparent nonvalidity of the isotopic-spin selection rule $\Delta T = \pm\frac{1}{2}$. (auth)

10671

Λ^0-NUCLEON POTENTIAL AND THE BINDING OF HYPERFRAGMENTS. Laurie M. Brown and Murray Peshkin (Northwestern Univ., Evanston, Ill.). Phys. Rev. 107, 272-4(1957) July 1.

The volume integral Ω of the effective interaction potential between the Λ hyperon and the nucleon has been calculated from the observed binding energies of hyperfragments of mass number 3, 4, 5, 7, and 9. An assumption of short-range, central, spin-independent forces leads to a single value of $\Omega = (240 \pm 20) \times 10^{-39}$ Mev cm^3, independent of experimental uncertainties in the size and shape of nuclei and in the observed binding energies, except for the case of $_\Lambda He^5$. The additional freedom gained by assuming central spin-dependent forces does not permit the fitting of $_\Lambda He^5$ and the other hypernuclei. It is concluded that the explanation of the anomalously low value of Ω for $_\Lambda He^5$ is to be found in the nuclear properties of its alpha-particle core. (auth)

10672

PAIR-CREATION CROSS SECTION OF SPIN ONE-HALF PARTICLES POSSESSING AN ANOMALOUS MAGNETIC MOMENT. George H. Rawitscher (Stanford Univ., Calif.). Phys. Rev. 107, 274-6(1957) July 1.

The electromagnetic pair-production cross section of spin-$\frac{1}{2}$ particles possessing an anomalous magnetic moment λ (in units of $e\hbar/2mc$) is calculated. The result is compared with the experimental measurement of the pair production of mu mesons, and it is found that $-0.4 < \lambda < 0.2$. (auth)

10673

STUDY OF K^- AND $\bar{K}^0$ MESON STARS IN EMULSION. R. G. Glasser, N. Seeman, and G. A. Snow (U. S. Naval Research Lab., Washington). Phys. Rev. 107, 277-9(1957) July 1.

108 K^- stars were found by area-scanning. The secondaries were followed and the hyperons were analyzed. The lifetime for $\Sigma^+ \rightarrow p + \pi^0$ is $(1.38_{-0.63}^{+1.38}) \times 10^{-10}$ sec and for $\Sigma^\pm \rightarrow n + \pi^\pm$ is $(0.31_{-0.10}^{+0.32}) \times 10^{-10}$ sec. The latter

figure is apparently in disagreement with the bubble chamber data on lifetimes of hyperons. Two events which were caused by $\overline{K}^0$ mesons are described. (auth)

10674

SCATTERING OF K^+ MESONS BY PROTONS. Donald I. Meyer (Brookhaven National Lab., Upton, N. Y. and Univ. of Michigan, Ann Arbor) and Martin L. Perl and Donald A. Glaser (Univ. of Michigan, Ann Arbor). Phys. Rev. 107, 279-82(1957) July 1.

The scattering of 20- to 90-Mev K^+ mesons by protons has been investigated by using a propane bubble chamber. On the basis of 32 events, a total cross section of 9.4 ± 1.7 mb is obtained. The experimental angular distribution is not isotropic. (auth)

10675

CHARACTERISTICS OF π^0 PRODUCTION FROM PROTON-PROTON COLLISIONS NEAR THRESHOLD. Burton J. Moyer and Robert K. Squire (Univ. of California, Berkeley). Phys. Rev. 107, 283-90(1957) July 1.

The angular distribution and excitation function for neutral mesons produced by proton-proton collisions near threshold have been measured. It is found that P-state production of the mesons dominates at all energies except those quite close to threshold, where some S-state production can be detected. The total cross section, at an energy where the maximum attainable c.m. meson momentum in $\eta_0 M_\pi c$, can be stated as σ(mb) $0.02\eta_0^2$ (S state) + $0.57\eta_0^8$ (P state). (auth)

10676

VERTEX CORRECTIONS TO THE PION K-MESON INTERACTION. S. F. Tuan (Univ. of California, Berkeley). Phys. Rev. 107, 300-1(1957) July 1.

A vertex correction to Schwinger's fundamental pion-K-meson interaction is calculated to second order by the covariant S-matrix formalism. Certain prescriptions are made with regard to coupling constant renormalization such that the analogy with similar procedures in quantum electrodynamics become evident. (auth)

10677

TWO-PION EXCHANGE POTENTIAL. Michiji Konuma and Hironari Miyazawa (Univ. of Tokyo) and Shoichiro Otsuki (Nagoya Univ., Japan). Phys. Rev. 107, 320-1(1957) July 1.

Results of numerical evaluations of the adiabatic nuclear potential, involving the exchange of two pions at most, expressed in terms of pion scattering cross sections are given. Graphs of the one-pion and two-pion exchange potentials are included. (M.H.R.)

10678

INFLUENCE OF STRONG MAGNETIC FIELD ON DEPOLARIZATION OF MUONS. J. Orear, G. Harris, and Enid Bierman (Columbia Univ., New York). Phys. Rev. 107, 322-3(1957) July 1.

Using the magnetic resonance setup of Garwin, Lederman, and Sachs, a field of 9 ± 1 kilogauss was applied along the beam direction to a small stack of G5 nuclear emulsions, in which μ^+ mesons from the 85-Mev Nevis π^+ beam were stopped. Results indicate that the data are free from forward-backward selection bias and that the application of an external magnetic field along the spin direction reduces the amount of depolarization and improves the nuclear emulsion as a tool for experiments involving mesons. (M.H.R.)

10679

SMALL-ANGLE PHOTOPRODUCTION OF POSITIVE MESONS FROM HYDROGEN. Edward Knapp, William Imhof, Robert W. Kenney, and Victor Perez-Mendez (Univ. of California, Berkeley). Phys. Rev. 107, 323-4(1957) July 1.

The relative angular distributions for the yield of positive pions produced by (260 ± 5)-Mev γ rays were measured. The differential cross sections were graphed, and the theoretical and experimental least-squares coefficients compared. (M.H.R.)

10680

EXPERIMENTAL SITUATION ON PARITY DOUBLING. F. Eisler, R. Plano, and N. Samios (Columbia Univ., New York), M. Schwartz (Brookhaven National Lab., Upton, N. Y.) and J. Steinberger (Univ. of Bologna, Italy). Phys. Rev. 107, 324-5(1957) July 1.

The applicability of the Treiman and Wyld revival of the parity-doubling theories, with a specific model in which the mean life of one of the K^+ states is short compared to 10^{-8} sec, is discussed. It is emphasized that it is difficult to reconcile any such model with experiment, unless this model is so constructed that the two parity states have equal lifetimes and identical decay modes. (M.H.R.)

10681

PROPOSED EXPERIMENT TO DETERMINE THE DIRECTION OF μ-MESON POLARIZATION IN PION DECAY. J. D. Jackson, S. B. Treiman, and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 107, 327-8(1957) July 1.

An experiment is proposed whereby the sign of the μ-meson polarization can be determined essentially directly and largely independent of theory by using the known directional asymmetries in beta decay. The experiment depends on the residual polarization of μ^- mesons when stopped and bound in K-shell orbits around nuclei. (M.H.R.)

10682

S-WAVE PIONS IN THE REACTION $p + p \rightarrow \pi^+ + d$. Frank S. Crawford, Jr. and M. Lynn Stevenson (Univ. of California, Berkeley). Phys. Rev. 107, 331-2(1957) July 1.

NEUTRONS

10683 WAPD-TM-63

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EFFECTIVE FAST GROUP CROSS SECTIONS IN FOUR GROUP THEORY. Paride A. Ombrellaro. May 1957. 30p. Contract AT-11-1-gen-14. $4.80(ph OTS); $2.70 (mf OTS).

The fast neutron group parameters in four-group diffusion theory are represented by effective microscopic cross sections. These effective cross sections are chosen to fit the P-1 group parameters obtained by the MUFT-3 code at essentially zero buckling and thereby simplify one stage of nuclear design calculations. The scheme described was developed as a replacement for MUFT in the automatic group constants preparation component of the CANDLE code for the study of reactor lifetime characteristics. (L.T.W.)

10684

THE NEW PARTICLE — ANTINEUTRON. L. L. Puzikov (Moscow Physico-Technical Inst.). Priroda, 46, No. 6, 69-71(1957) June. (In Russian)

The discovery and properties of antineutrons are reviewed. (R.V.J.)

NUCLEAR PHYSICS

10685 CRC-694

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A RE-ASSESSMENT OF TWO POSTULATES OF CHARGE DISTRIBUTION IN FISSION IN THE LIGHT OF NEW NUCLEAR DATA. W. E. Grummitt and Gwen M. Milton. May 1957. 16p. (AECL-453).

New nuclear mass data were used to re-evaluate Z_A, the most stable charge associated with a given mass, for use in the Glendenin, Coryell, Edwards postulate of charge distribution in fission yields. (D.E.B.)

10686 CU-157

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1956 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 39p. Contract AT-30-1-GEN-72. $6.30(ph OTS); $3.00(mf OTS).

Results and analysis of self-detection and transmission measurements on Ag, Ta^{181}, and U^{238} using a resolution of about 0.01 μ sec/m are given. A new set of measurements on the transmission of a liquid Bi sample was made to determine the neutron-electron interaction. The absorption cross sections of Au at 2200 m/sec was determined as 98.8 ± 0.3b from measuring the total cross section in the wavelength interval from 5 to 11.5Å units. The production of monopole pairs from the 7.6 Mev O^+ state in C^{12} was found to be $< 1.6 \times 10^{-5}$ that of the yield from the 4.43 Mev state. The strength function for S-wave protons was studied and the resonance for low energy protons should be shifted from A = 55 to A = 70 because of the neutron excess in these nuclei. A single-knob Van de Graaff high voltage control system was installed and found to work satisfactorily. A complete decay scheme of Br^{82} is proposed. The half-life of Ca^{39} was found to be 0.9 ± 0.02 sec, which is 8% lower than the latest published value. (For preceding period see CU-154.) (M.H.R.)

10687 CU-158

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH 1957 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 31p. Contract AT-30-1-GEN-72. $6.30(ph OTS); $3.00(mf OTS).

The 2200 m/sec neutron absorption cross section of B was determined as 756 ± 6b. A precision measurement of the $N^{15}(p,n)O^{15}$ threshold was made in terms of the $Li^7(p,n)Be^7$ threshold, giving a value of 3.7807 ± 0.0015 Mev. The 10.98 Mev state in O^{16} was assigned a O^- interval. An experiment for the test of time reversal by measuring β-γ angular correlation in oriented nuclei is described. The asymmetry of the beta emission of aligned Co^{58} nuclei was found to be opposite in sign to that of Co^{60}. The results are in good agreement with the two-component neutrino theory. Several discrepancies in the decay scheme of Rb^{82} were resolved. Crystals of the double salt $2Ce(NO_3)_3 \cdot 3Mg(NO_3)_2 \cdot 24H_2O$ were prepared. A concentrated Re^{184} source was prepared by bombarding W^{183} with 10 Mev deuterons. (M.H.R.)

10688 ORNL-2358

Oak Ridge National Lab., Tenn.
STUDIES OF THE SPHERICAL HARMONICS METHOD IN NEUTRON TRANSPORT THEORY: II. BEHAVIOR OF THE SOLUTION OF THE MILNE PROBLEM WITH ANISOTROPIC SCATTERING FOR $L \to \infty$. Walter Kofink. July 11, 1957. 43p. Contract W-7405-eng-26. $0.30(OTS).

10689

A GENERALIZATION OF THE DIRAC EQUATION FOR SLOW FERMIONS IN INTERACTIONS WITH MESON FIELDS. Parviz Merat. Compt. rend. 245, 38-40(1957) July 1. (In French)

In order to separate the isomorphism of the isotopic group from the Lorentz group, meson fields irreducible with respect to isotopic transformations were introduced. The interaction of an isovectorial meson field with the associated particle was studied by a generalization of the Dirac equation for slow fermions. The theory predicts new meson properties for the fermions. (tr-auth)

10690

EFFECTIVE ELECTRON-ELECTRON AND ELECTRON-ION CROSS SECTIONS IN PLASMAS. Michel Bayet. J. phys. radium 18, 380-6(1957) June. (In French)

Definitions of different effective cross-sections for elastic scattering are recalled, and it is pointed out that their values are infinite in the case of strictly Coulombian interaction (i.e., r^{-1} potential); but, in the case of actually existing electron gases, which are part of macroscopically neutral "plasmas" (because of positive ions), it is possible to find finite cross sections, if one uses the results of Debye's theory of electrolytes, which states that the potential obeys a $(r\, e^{r/D})^{-1}$ law (D = "Debye's length"). Conditions of applicability of this theory are discussed, and effective cross-sections calculated. They approximately vary as E^{-2} (E = electron energy), and are often very large, larger than the effective cross-sections between electrons and neutral molecules; this explains the failure of the theories which treat the ionized media as "Lorentz's gases" when trying to predict the form of the distribution function of electron velocities: this distribution function is nearly always Maxwellian, but at temperatures T_e that are much larger than the temperature T of the gaseous molecules. (auth)

10691

THE SLOWING DOWN OF LOW ENERGY ATOMIC PARTICLES. Michel Bayet. J. phys. radium 18, 413-14(1957) June. (In French)

10692

REMARKS ON PARITY CONSERVATION AND THE TWO-COMPONENT THEORY OF THE NEUTRINO. J. Serpe (Univ. of Liege, Belgium). Nuclear Phys. 4, 183-7(1957) Aug.

Attention is drawn to a property of the two-component neutrino theory which was established a few years ago by the author; namely, that this theory is equivalent to Majorana's abbreviated theory. Some comments are made on the particle-antiparticle concept and on the formulation of the β-interaction with the help of the two-component neutrino-field. (auth)

10693

FOKKER-PLANCK EQUATION FOR AN INVERSE-SQUARE FORCE. Marshall N. Rosenbluth, William M. MacDonald, and David L. Judd (Univ. of California, Berkeley). Phys. Rev. 107, 1-6(1957) July 1.

The contribution to the Fokker-Planck equation for the distribution function for gases, due to particle-particle interactions in which the fundamental two-body force obeys an inverse square law, is investigated. The coefficients in the equation, (Δv) (the average change in velocity in a short time) and $(\Delta v \Delta v)$, are obtained in terms of two fundamental integrals which are dependent on the distribution function itself. The transformation of the equation to polar coordinates in a case of axial symmetry is carried out. By expanding the distribution function in Legendre functions of the angle, the equation is cast into the form of an infinite set of one-dimensional coupled nonlinear integro-differential equations. If the distribution function is approximated by a finite series, the resultant Fokker-Planck equations may be treated numerically using a computing machine. Keeping only one or two terms in the series corresponds to the approximations of Chandrasekhar, and Cohen, Spitzer and McRoutly, respectively. (auth)

10694

FREE-INDUCTION DECAYS IN SOLIDS. I. J. Lowe and R. E. Norberg (Washington Univ., St. Louis, Mo.). Phys. Rev. 107, 46-61(1957) July 1.

A beat structure has been found on free-induction decays associated with the pulsed nuclear magnetic resonance of

nuclei in rigid lattices. A general quantum-mechanical theory is developed for the shapes of induction decays. The theory is specialized to the case of rigid solids and applied to the magnetic dipolar interactions among the F^{19} nuclei in a fluorite (CaF_2) crystal. It is also shown rigorously that, except at very low temperatures, a free-induction decay is the Fourier transform of the corresponding steady-state resonance line shape. The calculation of the shape of an induction decay in CaF_2 thus corresponds to the calculation of the shape of the F^{19} resonance line for the crystal. It is demonstrated that the resonance line shape for an ordered rigid lattice is not Gaussian. (auth)

10695

SPIN-ORBIT COUPLING IN THE PROTON-PROTON INTERACTION. J. L. Gammel and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 291-8 (1957) July 1.

The proton-proton interaction is examined at high energies. A phenomenological potential is derived from the scattering data. In the triplet state, this potential has a strong short-range ($\sim 0.4 \times 10^{-13}$ cm) repulsive core region, outside of which a long-ranged tensor force and extremely short-range spin-orbit ($L \cdot S$) force are effective. Good fits can be obtained to all the p-p data below 310 Mev. More important at 310 Mev the calculated phase shifts are very close to the phase shifts which give the best fit found in a phase-shift analysis of the 310-Mev data, and at all lower energies precision fits to the experimental data can be obtained by very slight (if any) changes in the calculated phase shifts. (auth)

10696

GAMMA-RAY RESONANCE SCATTERING ON NUCLEI. B. S. Dzhelepov. Uspekhi Fiz. Nauk 52, 3-40(1957) May. (In Russian)

The nuclear excitation resonance and its effects in all processes of discharge including strong γ-ray elastic and inelastic scattering were analyzed. (R.V.J.)

NUCLEAR PROPERTIES

10697 LA-2122

Los Alamos Scientific Lab., N. Mex.

FAST NEUTRON CROSS SECTIONS. CORRECTIONS TO LA-1714 AND A CORRELATION OF 3 MEV VALUES. Richard L. Henkel. Mar. 1, 1957. 14p. Contract W-7405-Eng-36. $3.30(ph OTS); $2.40(mf OTS).

10698

NUCLEAR MAGNETIC RESONANCE IN IRRADIATED TEFLON. Hazime Kusumoto (Univ. of Tokyo). J. Phys. Soc. Japan 12, 826(1957) July.

10699

LEVELS IN Bi^{206}. S. Wahlborn (Royal Inst. of Tech., Stockholm). Nuclear Phys. 3, 644-8(1957) July.

A theoretical investigation has been made of energy levels in Bi^{206} following the same principles as used by Pryce. Recent experimental results for the decay scheme of Bi^{206} have been interpreted according to the theoretical results. (auth)

10700

THE ENERGY LEVELS OF Pb^{206}. M. J. Kearsley (Univ. of Manchester). Nuclear Phys. 4, 157-70(1957) Aug.

The energy levels of Pb^{206} are calculated on the shell model, regarding Pb^{206} as two holes in the double closed shell nucleus Pb^{208}. The single hole energies are derived from data on Pb^{207}, and interaction energies are calculated using harmonic oscillator wave functions and a Yukawa potential. The lowest seven excited states with energies up to 3 Mev are in good agreement with experiment. (auth)

10701

THEORY OF INELASTIC SCATTERING OF GOLD NEUTRONS FROM LIQUID HELIUM. Michael Cohen and Richard P. Feynman (California Inst. of Tech., Pasadena). Phys. Rev. 107, 13-24(1957) July 1.

A measurement of the energy losses of monoenergetic neutrons scattered from liquid He II would permit a determination of the energy-versus-momentum relation for the elementary excitations (phonons and rotons) in the liquid. A major part of the scattering at a fixed angle arises from production or annihilation of a single excitation and appears as sharp lines in the energy spectrum. From the position of these lines the energy-versus-momentum relation of the excitations can be inferred. Other processes, such as production or annihilation of multiple excitations, contribute a continuous background, and occur at a negligible rate if the incident neutrons are slow ($\lambda \gtrsim 4A$) and the He cold ($T < 2°K$). The total cross-section data can be accounted for by production of single excitations; the theoretical cross section, computed from a wave function previously proposed to represent excitations, agrees with experiment over the entire energy range, within 30%. Line widths in the discrete spectrum are negligible at 1°K because of the long lifetime of phonons and rotons. (auth)

10702

F^{19} NUCLEAR MAGNETIC RESONANCE LINE SHAPES IN CaF_2. C. R. Bruce (Washington Univ., St. Louis, Mo.). Phys. Rev. 107, 43-5(1957) July 1.

The F^{19} magnetic resonances have been measured in CaF_2 with the magnetic field along the [100], [110], and [111] crystal directions and these data are compared with the data of Pake and Purcell. Calculations of the second and fourth moments for the new data further confirm the theory of Van Vleck on magnetic dipole interactions in solids since improved agreement with theory is obtained in the case of the magnetic field along the [111] crystal direction. Corrections of the moments for modulation broadening were small. (auth)

10703

STARK EFFECT ON CESIUM-133 HYPERFINE STRUCTURE. R. D. Haun, Jr. and J. R. Zacharias (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 107-9 (1957) July 1.

The change of the hyperfine-structure separation energy caused by an electric field has been measured in Cs^{133} by the atomic-beam magnetic-resonance method. The shift of the $(F = 4, m_F = 0) \leftrightarrow (F = 3, m_F = 0)$ transition frequency in the electric field ϵ is given by $\Delta(\epsilon) = -2.29 \times 10^{-6}(1 \pm 0.03)\ \epsilon^2$ cps, where ϵ is in volts/cm. This number is 2.8 times the value predicted from the atomic polarizability measurements of Scheffers and Stark if a simplified theory which neglects hyperfine-structure perturbations of the ground-state wave functions is used. (auth)

10704

EVIDENCE FOR SMALL DEVIATIONS FROM THE ALLOWED SHAPE IN THE COMPARISON OF THE BETA SPECTRA OF Na^{24} AND P^{32}. F. T. Porter, F. Wagner, Jr., and M. S. Freedman (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 135-8(1957) July 1.

Two low-Z, similar-in-energy, presumably allowed beta transitions, $Na^{24}(E_0 = 1394$ kev, $4+ \rightarrow 4+$, log $f_0t = 6.1)$ and $P^{32}(E_0 = 1711$ kev, $1+ \rightarrow 0+$, log $f_0t = 7.9)$ have been compared by means of the Argonne double-lens spectrometer at 2% resolution. Vacuum-distilled sources on 200 $\mu g/cm^2$ Al had thicknesses of 50 to 75 $\mu g/cm^2$ for Na^{24} and $\ll 50$ $\mu g/cm^2$ for P^{32}. Considerable attention has been given the question of detector efficiency and instrumental scattering. The results show that Na^{24} has very nearly the allowed shape; its experimental shape factor, $(N/[f(E_0-E)^2])$, is

within 0.5% that given by L_0 between 110 and 1300 kev. In contrast, the experimental shape factor for P^{32} decreases about 3% from 270 to 1630 kev with a slope ~4 times that of L_0. It is concluded that there is definite evidence for small deviations from the allowed shape in one of these transitions, and further, with a lower confidence level, that the slower P^{32} transition shows the deviation. While the deviation in P^{32} is not inconsistent with previous limits set on T-A interference, the large f_0t of P^{32} suggests that second-order effects may hold the explanation. (auth)

10705

INELASTIC NEUTRON SCATTERING FROM RHODIUM AND NIOBIUM. M. A. Rothman, D. M. Van Patter, V. S. Dubey, W. C. Porter, and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 107, 155-8(1957) July 1.

Inelastic scattering of neutrons has been used to study excited states in Rh^{103} and Nb^{93}. Gamma rays have been observed from the 300- and 365-kev levels in Rh. Gamma rays of 736- and 957-kev energy have been obtained from Nb. As a result of threshold measurements, these gamma rays are interpreted as representing transitions to the 29-kev metastable state from levels at 764 and 977 kev in Nb. (auth)

10706

INELASTIC PROTON SCATTERING FROM PHOSPHORUS AND ZINC. D. M. Van Patter, M. A. Rothman, W. C. Porter, and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 107, 171-5(1957) July 1.

Inelastic proton spectra from targets containing P and Zn have been studied at bombarding energies of 3.72 and 4.66 Mev using a double-focusing spectrometer. Proton groups have been observed corresponding to levels in P^{31} at 1.264 ± 0.004, 2.230 ± 0.005, 3.134 ± 0.006, and 3.292 ± 0.005 Mev. Excitation curves for these four inelastic groups measured in the region of E_p = 4.55 to 4.70 Mev show the same general resonant structure, although differing in detail. At E_p = 4.66 Mev, no additional groups from P^{31} were observed for the excitation region 0 to 1.26 Mev with an intensity greater than 2% of the intensity of the first excited state group. Four inelastic proton groups were observed from zinc. From a comparison with the known level schemes of the zinc isotopes, three of these groups were assigned to the following isotopes: Zn^{64}, 0.991 ± 0.005 Mev; Zn^{66}, 1.038 ± 0.005 Mev; and Zn^{68}, 1.078 ± 0.005 Mev. The remaining group with Q = −1.802 ± 0.005 Mev remains unassigned. (auth)

10707

SPINS OF THALLIUM-197, -198m, -199, AND -204, AND THE HYPERFINE-STRUCTURE SPLITTING OF THALLIUM-204. G. O. Brink, J. C. Hubbs, W. A. Nierenberg, and J. L. Worcester (Univ. of California, Berkeley). Phys. Rev. 107, 189-95(1957) July 1.

The nuclear angular momenta of four isotopes of Tl and the hyperfine-structure splitting of Tl^{204} in the $^2P_{\frac{1}{2}}$ state have been measured by the atomic-beam magnetic resonance method. The results are: for 2.7-hr Tl^{197}, $I = \frac{1}{2}$; for 1.8-hr $Tl^{198\,m}$, I = 7; for 7.2-hr Tl^{199}, $I = \frac{1}{2}$; for 4.1-yr Tl^{204}, I = 2 and $\Delta\nu(^2P_{\frac{1}{2}})$ = 732 ± 5 Mc/sec. The neutron-deficient isotopes are produced by alpha-particle bombardment of gold in the Berkeley 60-inch cyclotron; Tl^{204} is produced by neutron activation of metallic thallium samples. (auth)

10708

DEUTERON–PROTON SCATTERING AT 11.7 Mev. R. O. Kerman (Kalamazoo Coll., Mich.) and Roy Nilson (Univ. of Illinois, Urbana). Phys. Rev. 107, 200-2(1957) July 1.

Absolute differential scattering cross sections for deuteron-proton scattering at an incident deuteron energy of 11.7 ± 0.15 Mev have been obtained by using Ilford C-2 nuclear plates as detectors, with an accuracy of about 1% at a number of angles from 70 to 150° in the center-of-mass system. The results appear to be in good agreement with the cross sections obtained by other experiments in this energy range. (auth)

10709

APPRECIATION OF A VELOCITY-DEPENDENT POTENTIAL TO THE NUCLEAR PHOTOEFFECT. S. Rand (Univ. of California, Berkeley). Phys. Rev. 107, 208-14 (1957) July 1.

Calculations of the total photonuclear absorption cross sections have been carried out for a number of nuclei throughout the periodic table. The shell model, with a velocity-dependent potential, has been used. This potential is proportional to the kinetic energy of the nucleons, and gives rise to a changed effective nucleon mass. One of the effects of such an effective mass is to change the frequencies of the giant gamma-ray absorption resonances. Previous independent-particle model calculations had resulted in frequencies consistently lower than the observed values. With an effective nucleon mass inside the nucleus of about 55% of the normal mass, very good agreement with the experimental values is obtained for medium and heavy nuclei. Within the limits of the assumptions made in the calculations, the forms of the observed excitation curves are closely reproduced, and are peaked at roughly the correct energies. Furthermore, the cross sections integrated over excitation energies, which are nearly model-independent quantities in the changed-mass case, are, except for the very light nuclei, consistent with the experimental values. (auth)

10710

CROSS SECTIONS FOR ANTIPROTONS IN HYDROGEN, BERYLLIUM, CARBON, AND LEAD. Bruce Cork, Glen R. Lambertson, Oreste Piccioni, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 107, 248-56 (1957) July 1.

A strong-focusing momentum channel has been arranged to form a beam from antiprotons produced by 6.0-Bev protons striking an internal target of the Bevatron. The channel consists of five 4-inch-diameter magnetic quadrupole lenses and two deflecting magnets adjusted to give a ±5% momentum interval. The antiprotons were selected from a large background of mesons by a scintillation counter telescope with a time-of-flight coincidence circuit having a resolution of $\pm 2 \times 10^{-9}$ second. This system allowed detection of approximately 400 antiprotons per hour. With a liquid hydrogen attenuator, the total antiproton-proton cross section at four different energies, 190, 300, 500, and 700 Mev, has been observed to be 135, 104, 97, and 94 mb, respectively. Also, the total cross sections for antiprotons incident on Be and C have been measured at two energies. The inelastic cross sections for carbon have been measured by observing the pulse heights produced by the interactions in a target of liquid scintillator. To measure the inelastic cross section for a high-Z element, lead wafers were immersed in the liquid scintillator, and to select inelastic events the pulse heights were measured. (auth)

10711

ENERGIES OF $f_{\frac{n}{2}}$ NUCLEAR CONFIGURATIONS. Igal Talmi (Princeton Univ., N. J.). Phys. Rev. 107, 326-7 (1957) July 1.

10712

MAGNETIC DIPOLE MOMENT OF THE ELECTRON. Charles M. Sommerfield (Harvard Univ., Cambridge, Mass.). Phys. Rev. 107, 328-9(1957) July 1.

The fourth-order radiative corrections to the magnetic

dipole moment of the electron were recalculated using the mass-operator formalism of Schwinger. (M.H.R.)

10713

STABILIZATION AND CONTROL OF ELECTROMAGNETS IN MAGNETIC PROTON RESONANCE. H. Andresen. Z. angew. Phys. 9, 326-33(1957) July. (In German)

NUCLEAR REACTORS

10714 AECU-3427

Internuclear Co., Inc., Clayton, Mo.

PRELIMINARY INVESTIGATIONS FOR AN ADVANCED ENGINEERING TEST REACTOR. O. J. Elgert, C. F. Leyse, and D. G. Ott. Feb. 22, 1957. 133p. Contract AT(11-1)-500. (INTERNUC-9). $0.85(OTS).

A study was carried out to determine a suitable reactor system or systems for the testing of water, gas, and liquid-metal cooled fuel assemblies. The unperturbed thermal neutron fluxes in the test holes are to be 1 to 1.5 × 10^{15} n/cm^2sec. A group of seven separately cooled and controlled reactors assembled in a common shield are proposed to meet the test facility requirements. Each of the reactors consists of the central test thimble, surrounded consecutively by an H_2O annulus, reactor core, and D_2O reflector. The estimated total power of the seven reactors is about 450 Mw when the neutron flux requirements are met in all the test holes. (auth)

10715 AERE-RE/R-1684

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A POSSIBLE ARRANGEMENT OF A SWIMMING POOL TYPE EXPERIMENTAL REACTOR. R. F. Jackson, ed. May 19, 1955. 20p.

A preliminary design study is reported of a swimming pool type reactor arranged for general research use and providing a maximum flux of 10^{12} n/cm^2/sec at 100 kw with the possibility of short-period operation at 1 Mw. (auth)

10716 AERE-R/R-2108

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THEORETICAL THERMAL NEUTRON FLUX DISTRIBUTION IN EMPTY CHANNELS IN REACTORS. D. A. Newmarch. Dec. 30, 1956. 30p.

By means of the spherical harmonics method, expressions are derived for the thermal neutron flux distributions in the air channels of reactor assemblies where the fuel elements are in the form of cylindrical rods and tubes. These expressions have been evaluated for a few cases of graphite moderated assemblies. (auth)

10717 ANL-5688

Argonne National Lab., Lemont, Ill.

THE MIGHTY MOUSE RESEARCH REACTOR; PRELIMINARY DESIGN STUDY. L. E. Link, W. H. Cook, H. Greenspan, C. N. Kelber, J. Ramuta, and B. I. Spinrad. Mar. 1957. 85p. Contract W-31-109-eng-38. $0.50(OTS).

The design of a 250-Mw heterogeneous reactor, with a peak thermal neutron flux level of about 5 × 10^{15} n/(cm^2)(sec), is proposed for basic research, neutron-beam experimentation, and irradiation studies at an Argonne site. The design concept features a D_2O-cooled, moderated, and reflected annular core (30 cm ID, 90 cm OD, 90 cm high) of highly enriched, magnesium-clad fuel elements contained in a pressure vessel approximately 13 ft in diameter. Included are the results of preliminary studies directed toward establishing the avenues of research and development necessary to resolve the problems of heat transfer, fuel fabrication and handling, control, and shielding inherent to the proposed reactor operating cycle of 5 days. (auth)

10718 ANL-5711

Argonne National Lab., Lemont, Ill.

EBWR PHYSICS EXPERIMENTS. J. A. Thie. July 1957. 31p. Contract W-31-109-eng-38. $0.25(OTS).

The results of a number of zero power experiments, as well as the initial power generation experiments, are reported. These include critical mass determinations, control rod calibrations, void and temperature coefficient measurements, determinations of reactivity compensated by steam voids, and the effect of boric acid and control rods on power generation. A low-power, low-pressure, oscillation phenomenon, is described. Except for the latter, virtually all results are understood, quantitatively, by existing boiling reactor theories, although in some cases the desired precision is lacking. (auth)

10719 ANL-5742

Argonne National Lab., Lemont, Ill.

ESTIMATION OF FISSION PRODUCT SPECTRA IN DISCHARGED FUEL FROM FAST REACTORS. Leslie Burris, Jr. and Ira G. Dillon. July 1957. 57p. Contract W-31-109-eng-38. $0.40(OTS).

The fission product spectra in discharged fuel from fast fission power reactors were calculated over a wide range of operating conditions (reactor operating times from 10 to 10,000 days and cooling times from zero to infinity). These calculations are based on recent yield data for fission of U and Pu. From these calculated data are presented derived values of total curies and energy dissipation rates as functions of operating time and cooling time. (auth)

10720 APAE-Memo-99

Alco Products, Inc., Schenectady, N. Y.

INSPECTION OF DUMMY FUEL LOADING USED DURING THE NON-CRITICAL TEST RUN. E. C. Edgar. June 3, 1957. 29p. Contract AT(11-1)-318. $4.80(ph OTS); $2.70(mf OTS).

The imperfections found during inspection of APPR fuel plates are discussed. (D.E.B.)

10721 APAE-Memo-107

Alco Products, Inc., Schenectady, N. Y.

COMPARISON OF PREDICTED AND ACTUAL CONTROL ROD DROP TIME FOLLOWING SCRAM OF THE APPR-1. J. O. Brondel. July 12, 1957. 23p. Contract AT(11-1)-318. $4.80(ph OTS); $2.70(mf OTS).

A detailed analysis of hydraulic and mechanical forces affecting control rod drop time was made to determine a mathematical expression for rod position in terms of elapsed time after initiation of a scram. The elapsed time analyzed is exclusive of the instrument delay and clutch decay intervals. A comparison of predicted rod drop to actual field measurement shows good agreement both with and without primary loop flow. (auth)

10722 BMI-1196

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECTIVENESS OF CONTROL-ROD MATERIALS. Russell W. Dayton. June 24, 1957. Appendix: DERIVATION OF EXPRESSION FOR EFFECTIVENESS. R. F. Redmond. 40p. Contract NObs-65057 (Affiliated with W-7405-eng-92). $6.30(ph OTS); $3.00(mf OTS).

Studies were made of empirical methods for computing the effectiveness of control-rod materials. In spite of the incompleteness of available cross-section data, it was possible to correlate measured and computed effectiveness of a number of elemental materials and of dispersions within about 2 per cent. This is approximately the error of measurement. These calculational methods are expected to prove useful in the development of improved control materials by predicting combinations of materials which will possess high control-effectiveness. (auth)

10723 BMI-1198

Battelle Memorial Inst., Columbus, Ohio.

MODEL STUDIES OF FLOW IN THE THERMAL-SHIELD PASSAGES OF THE PWR REACTOR. Lawrence J. Flanigan and Herbert R. Hazard. June 26, 1957. 41p. Contract W-7405-Eng-92. $0.30(OTS).

Flow studies were made to obtain data for design of flow restrictions in thermal-shield coolant passages and for design of the flow baffle for the PWR reactor. The studies were made using air, in both a quarter-scale model of the reactor and in a 1.5-scale model of a section of the flow passages. Data obtained from the two models were then used as a basis for selecting sizes of restricting orifices and short tubes for the prototype, and for design of the flow baffle to provide the correct flow through the shield passages. In the model studies, the flow through the thermal-shield passages did not prove proportional to total reactor flow. Instead, the percentage of flow through the shield passages diminished as the number of operating loops was increased because of an increase in the flow coefficient of the perforated flow baffle. Detailed studies of flow in shield passages showed that there may be considerable variation in both velocity and direction of flow in Channel 1, the outer channel, resulting from asymmetrical flow conditions in the lower plenum. However, mass transfer exists throughout the cooling annuli under all operating conditions; therefore, no stagnant regions are present, and adequate cooling will be provided. (auth)

10724 CF-56-8-204(Del.)

Oak Ridge School of Reactor Technology, Tenn.

FUSED SALT FAST BREEDER. Reactor Design and Feasibility Study. J. J. Bulmer, E. H. Gift, R. J. Holl, A. M. Jacobs, S. Jaye, E. Koffman, R. L. McVean, R. G. Oehl, and R. A. Rossi. Aug. 1956. Decl. with deletions Mar. 5, 1957. 210p. $1.00(OTS).

An externally cooled, fused salt, fast breeder reactor producing 700 Mw of heat was designed utilizing Pu as the fuel in a mixture of the chlorides of Na, Mg, U, and Pu. Depleted U is used as the fertile material in a blanket of UO_2 in Na. Nuclear calculations were performed with the aid of the UNIVAC for multi-group, multi-region problems to obtain an optimum nuclear design of the system with the chosen fused salt. Steam temperature and pressure conditions at the turbine throttle were maintained such that the incorporation of a conventional turbine-generator set into the system design is possible. An economic analysis of the system, including estimated chemical processing costs was prepared. The analysis indicates that the fused salt system of this study has an excellent potential for meeting the challenge of economic nuclear power. It was not learned until the completion of the study of the severe (n,p) cross section of the Cl^{35} in the range of energies of interest. This effect was amplified by the large Cl/Pu ratio present. It was determined, however, that Cl^{37} had a high enough threshold for the (n,p) reaction so that it could be tolerated in this reactor. The requirement for Cl^{37} necessitates an isotope separation which is estimated to add 0.5 mils per kwhr to the cost of power. The power cost would then be 7.0 mils per kwhr instead of the 6.5 mils per kwhr reported. (auth)

10725 CF-57-6-66

Oak Ridge National Lab., Tenn.

TEST RESULTS ON A HEATER-COOLER UNIT FOR THE ORR IN-PILE LOOP. T. H. Mauney and H. C. Savage. June 28, 1957. 22p. Contract [W-7405-eng-26]. $4.80 (ph OTS); $2.70(mf OTS).

Tests were completed on a combination heater-cooler unit for use in in-pile loops designed to operate in beam hole NH-1 of the ORR facility. The combination unit is designed to remove fission heat generated in the circulating fuel solution during in-pile operation, as well as to supply the heat necessary for loop temperature control. Test results indicate that with a coolant mixture (air-water) of ~ 4scfm of air and ~ 270 cc/min of water, ~ 8 kw of heat can be removed at a loop temperature of 250°C. The cooling capacity can be varied ~ 1 kw to 8.5 kw by adjusting the water injection rate. (W.L.H.)

10726 CRE-707

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE CALCULATION OF OUTPUT AND REACTIVITY LOAD OF LOOPS IN NRU. C. D. McKay and L. A. Smith. June 24, 1957. 51p. (AECL-456).

The method that has been used by the authors for the estimation of the reactivity load and output power of proposed loops in NRU is described in some detail. The results of the calculations for a number of specific loop proposals are given graphically. (auth)

10727 DP-208

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

REACTIVITY COMPARISONS BETWEEN COBALT AND LITHIUM–ALUMINUM ALLOY. Harold R. Fike. Mar. 1957. 16p. Contract AT(07-2)-1. $0.20(OTS).

The experiments described were undertaken to compare neutron absorption properties between slug assemblies containing Co that were supplied by BNL and slugs containing different concentrations of Li in Li-Al alloy. All slugs were approximately 0.81 inch in diameter. The slug assemblies containing Co were constructed in three different configurations: (1) slabs of Co embedded in cylinders of Al; (2) annular cylinders of Co surrounding cylinders of Al; and (3) slabs of Co arranged on triangular prisms of Al. The Co slabs that were embedded in Al were 10.08 in. long and 0.76 in. wide. When the thickness of these slabs was varied from 0.040 to 0.180 in., the assemblies were equivalent to Li-Al alloy slugs containing from 1.0 to 4.0% Li by weight. A nearly linear relationship existed for all the slab assemblies tested when the equivalent absorptions were plotted against the volume of Co per unit length of slab. An assembly with an annular cylinder of Co which was 0.040 inch thick and had an inside diameter of 0.67 inch was equivalent to a slug containing 3.5% Li by weight. (auth)

10728 E-443/N-3

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

DETERMINATION OF OPTIMUM GAP BETWEEN FUEL PLATES. I. Everson. Oct. 28, 1953. 10p.

The effects of gap, D_2O temperature, sheath temperature, and D_2O flow on fuel plates were studied, and the optimum gap size was found to be 0.45 cm at a sheath temperature of 88°C and a flow rate of 925 lb/sec. (M.H.R.)

10729 IDO-16317

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CALCULATIONS OF REACTIVITY BEHAVIOR DURING SPERT-I TRANSIENTS. R. W. Miller. June 1, 1957. 35p. Contract AT(10-1)-205. $0.30(OTS).

Response of the SPERT-I reactor to stepwise insertions of reactivity has been investigated and previously reported. Using experimental power data from these excursions along with the familiar diffusion approximation kinetic equations, it has been possible in most cases to calculate the combined time-dependent effect of the shutdown mechanisms on the reactivity of the system during transient response. These data along with transient power and

energy release are presented on composite graphs for a number of excursions ranging in period and reactivity insertions from $\tau = 2$ sec and $\Delta k_0 = 0.48\%$ to $\tau = 0.007$ sec and $\Delta k_0 = 1.4\%$. From the data calculated in this fashion the amount of reactivity which was compensated at the peak of the first power burst may be observed. These values are dependent upon the transient period as well as other reactor parameters and are presented in graphical form. Included in the appendices are brief discussions of the numerical solutions of the kinetic equations and the limitations of these equations under this usage. (auth)

10730 IDO-16325
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NUCLEAR CALCULATIONS FOR SPERT III. H. L. McMurry. Mar. 25, 1957. 20p. Contract AT(10-1)-205. (PTR-93(Rev.)). $0.20(OTS).

This is a declassified, revised version of PTR-71.

The results of preliminary critical size and control rod worth calculations for the first SPERT III core design are given. This design assumed that adequate control can be obtained by blade type rods operating in slots similar to the design in SPERT I. The critical size calculations take account of the effect of this slot. When it was determined that blade type control rods would probably be inadequate, control rod calculations were made assuming a homogeneous core with fuel bearing shim rods. These calculations indicate a critical mass of ~20 kg at 650°F and an excess k of ~20% when loaded to this size at 68°F. While this work was in progress the SPERT III design was altered to eliminate the blade type rods and the slot accommodating them. Critical size and control rod calculations more pertinent to the actual design will be described in a separate report. (auth)

10731 IDO-16326
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THREE AND TWO GROUP CONSTANTS FOR A SPERT III CORE. D. R. Metcalf and R. Haldin. Apr. 11, 1957. 17p. Contract AT(10-1)-205. (PTR-102(Rev.)). $0.20 (OTS).

Several SPERT cores will use high U^{235} concentrations with the result that epithermal fissioning may be important. Also, the combination of stainless steel and high U^{235} densities may cause significant flux depressions in the core. To take better account of these effects, three group constants have been calculated for the SPERT III core with stainless steel fuel assemblies. These results, together with estimations of the flux depression effects, are given. (auth)

10732 IDO-16382
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NOTE ON THE EFFECT ON REACTIVITY OF WATER ANNULI IN LARGE VOID SPACES IN THE SPERT-I REACTOR CORE. G. O. Bright and C. R. Toole, Jr. July 1, 1957. 9p. Contract AT(10-1)-205. $0.15(OTS).

An experiment was performed in SPERT-I to determine the effect of various water annuli in large core void spaces. Results show that the maximum reactivity effect with a 3 × 3 × 24 in. void occurs with a 0.25 in. thick water annulus. The effect of these results on the evaluation of potential reactor hazards is discussed. (auth)

10733 KAPL-1726
Knolls Atomic Power Lab., Schenectady, N. Y.
DEVELOPMENT OF ZIRCALOY-CLAD, DISCRETE BURNABLE POISON ELEMENTS FOR S3G/S4G. G. F. McKittrick and W. A. Neisz. June 15, 1957. 29p. Contract W-31-109-Eng-52. $0.25(OTS).

A discrete Zr burnable poison element was successfully fabricated; however, because of the damage incurred as a result of irradiation, it is not considered usable for the S3G/S4G reactors. The results of pre- and post-irradiation tests performed on model elements are presented as well as the conclusions drawn and recommendations for further investigation. (auth)

10734 KAPL-M-JKD-11
Knolls Atomic Power Lab., Schenectady, N. Y.
THE RELOADING CYCLE FOR A POWER REACTOR. J. K. Davidson. Mar. 19, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Two methods of incremental reloading of the fuel in a power reactor are analyzed. The resulting reloading patterns are illustrated by applications to a cylindrical fuel region. (auth)

10735 KAPL-M-RCR-5
Knolls Atomic Power Lab., Schenectady, N. Y.
FLAT FLUX LOADING. R. C. Rohr. Apr. 18, 1957. 22p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70 (mf OTS).

A two zone reactor loading is described which produces a flat radial flux with a radial buckling of 0.6×10^{-4} cm^2. Use of this reactor to test small test lattices is described and a plot of reactivity perturbation vs. buckling, and the flux distributions at two energies are given for several lattices with known bucklings. Comparison of the experimental loading is made with the theoretical predictions indicating reasonable agreement. Some of the safety aspects of the highly moderated, multizone reactor are also discussed. Details of the reactor composition are given. (auth)

10736 NAA-SR-1941
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH, 1957. R. W. Dickinson, ed. July 1, 1957. 54p. Contract AT(04-3)-49. $0.40(OTS).

Criticality and nuclear parameter calculations were initiated for edge-loaded hexagonal moderator core configurations. A cost comparison was made of Na heat transfer systems using stainless steel and Cr–Mo alloy. Loading experiments on the SRE indicate the dry, room temperature critical loading is 22.2 fuel elements. Flux maps were made of the dry, subcritical core. Fuel specimens from the MTR were examined. The examination results substantiated previous data on metal swelling under hot irradiation. U slug casting in thin-walled molds using pressure and static casting techniques was satisfactorily demonstrated. Static and dynamic corrosion of Be by liquid Na was measured. The performances of Mark I and Mark II control rods were compared. (For preceding period see NAA-SR-1875.) (D.E.B.)

10737 WAPD-MRP-68
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD APRIL 24, 1957 TO JUNE 23, 1957. 99p. Contract AT-11-1-GEN-14. $0.55(OTS).

The status of PWR project development is summarized. Short-lived activity released by a UO_2 specimen containing a single defect began at a level nearly as high as that from a specimen of the same material containing 4 defects, but fell by a factor of 10 during the test. The calculated radiation dose rates due to corrosion and fission product contamination of the PWR primary system are given. Water withdrawn from the X-1 loop at Chalk River was passed through beds of MB-1 ion-exchange resin after a 45-day

decay period. The concentrations of radioisotopes were reduced by factors in excess of those required for the corresponding operations in the PWR waste disposal system. (For preceding period see WAPD-MRP-67.) (M.H.R.)

10738 WAPD-PM-32
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CRITICAL EXPERIMENTS ON SLIGHTLY ENRICHED URANIUM–ZIRCONIUM ASSEMBLY. K. R. Hovatter. Oct. 11, 1955. 33p. $6.30(ph OTS); $3.00(mf OTS).

The first critical assembly studied in the PWR Flexible Critical Facility was a slightly enriched U–Zr and H_2O reactor. The effective mass enrichment was 1.23%. The effective metal-to-water volume ratio was 0.80. The experiments which were performed with this assembly are described. Attempts have been made to analyze certain portions of the experimental data, and these attempts are also reported. (auth)

10739 WAPD-PWR-CP-2027(Rev.)
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
EVALUATION OF THE REFERENCE PWR FUEL ELEMENT FAILURE DETECTION SYSTEM. Paul W. Frank. [Aug. 7, 1956]. 13p. $3.30(ph OTS); $2.40(mf OTS).

The system evaluated consisted of a cation column followed by a scintillation probe to detect iodine gammas from failed elements. The system was discarded for lack of sensitivity. (D.E.B.)

10740 WAPD-TH-53
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE CALCULATION OF MEAT ECCENTRICITY HOT CHANNEL FACTORS FOR ROD-TYPE FUEL ELEMENTS. B. W. LeTourneau and R. E. Grimble. Apr. 8, 1955. Changed from OFFICIAL USE ONLY Aug. 7, 1957. 8p. Contract AT-11-1-GEN-14.

10741
THE COOLING OF THE REACTORS AT MARCOULE. J. Chaboseau. Industries Atomiques No. 7 and 8, 67-72 (1957) June-July. (In French)

The Marcoule reactors are described, and the pile arrangement and accessory equipment for cooling are given. (T.R.H.)

10742
REACTORS ON THE LINE. EXPERIMENTAL BOILING WATER REACTOR. Nucleonics 15, No. 7, 52a-3(1957) July.

Characteristics of the Experimental Boiling Water Reactor are outlined. Schematic sketches and photographs illustrate the description. (C.H.)

10743
SIGNIFICANCE OF EBWR. Nucleonics 15, No. 7, 54-7 (1957) July.

Operating experience with the Experimental Boiling Water Reactor has shown that the reactor can produce electricity on a basis that would satisfy normal utility operating practices and that boiling-water reactors can produce stable power under a varying demand load. Turbine contamination in a direct steam cycle appears so far not to be a worry, but there is a possibility that resonance instability may prove to be an inherent characteristic. (C.H.)

10744
EBWR POWER COSTS. Leonard E. Link (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 7, 58-9 (1957) July.

A summary of cost figures for the Experimental Boiling Water Reactor is presented in tabular form and discussed briefly. While initial costs are high, operation at higher power level and with heavy water will lower costs. (C.H.)

10745
STARTING UP EBWR. Joseph W. Harrer (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 7, 60-4 (1957) July.

Critical experiments for the Experimental Boiling Water Reactor were carried out in the reactor itself after it was built. The critical experiments and start-up experiences are described. (C.H.)

10746
FOOD-IRRADIATION REACTOR. D. T. Bray and C. F. Leyse (Internuclear Co., Clayton, Mo.). Nucleonics 15, No. 7, 76-9(1957) July.

A conceptual design is presented of a reactor-irradiator system to meet the Quartermaster Corps requirements for food irradiation. The reactor has an MTR-type core surrounded by a light-water solution of indium sulfate. This solution is circulated between the blanket and irradiators in another building in which food is irradiated. C.H.)

10747
APPLYING THERMODYNAMICS TO LIQUID-METAL-FUEL REACTOR TECHNOLOGY. James J. Egan and Richard H. Wiswall, Jr. (Brookhaven National Lab., Upton, N. Y.). Nucleonics 15, No. 7, 104-6(1957) July.

10748
FRENCH REACTOR INSTRUMENTATION. J. Weill. Nucleonics 15, No. 8, 45-9(1957) Aug.

Reactor control and monitoring instruments used with French reactors are described. (C.H.)

10749
PLASMA REACTOR PROMISES DIRECT ELECTRIC POWER. S. A. Colgate (Univ. of California, Livermore) and R. L. Aamodt (Los Alamos Scientific Lab., N. Mex.). Nucleonics 15, No. 8, 50-5(1957) Aug.

A conceptual design is presented of a power reactor which converts fission energy directly into electricity by causing ionized U^{235} gas to interact with a magnetic field. (C.H.)

10750
DESIGN AND COST ESTIMATE FOR A PYROMETALLURGICAL REPROCESSING PLANT. Louis Basel (Atomic Power Development Associates, Inc., Detroit, Mich.) and Joseph Koslov (Vitro Corp. of America, New York). Nucleonics 15, No. 8, 56-60(1957) Aug.

A conceptual design is presented of a pyrometallurgical reprocessing plant for reprocessing enriched fuel of the Enrico Fermi fast breeder reactors. The design presented uses the oxide-slagging method, and can handle 18,000 kg/yr of enriched U alloy at an estimated $79/kg. The highly radioactive product requires remote fabrication. (C.H.)

10751
REACTORS ON THE LINE. ARMY PACKAGE POWER REACTOR. Nucleonics 15, No. 8, 60a(1957) Aug.

Design characteristics of the Army Package Power Reactor are summarized. Schematic sketches of components are included. (C.H.)

10752
SPECIAL POWER EXCURSION REACTOR TEST III. T. R. Wilson (Phillips Petroleum Co., Idaho Falls). Nucleonics 15, No. 8, 68-71(1957) Aug.

10753
TEFLON CRITICAL-EXPERIMENT FUEL ELEMENTS. J. L. Swanson and F. H. Welch (General Electric Co., Cincinnati, Ohio). Nucleonics 15, No. 8, 90, 92-3(1957) Aug.

10754
GLASS FIBERS. A NEW FORM FOR REACTOR FUELS. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). Nucleonics 15, No. 8, 94-8(1957) Aug.

10755
LINEAR KINETICS OF HOMOGENEOUS REACTORS. Walter Humbach. Z. angew. Phys. 9, 333-5(1957) July. (In German)

Refer also to abstracts 10388, 10507, and 10663.

NUCLEAR TRANSFORMATION

10756
TWO CLOSELY SPACED RESONANCES IN THE REACTION $Al^{27}(p,\gamma)Si^{28}$. S. L. Andersen, T. Holtebekk, O. Lönsjö, and R. Tangen (Univ. of Oslo, Blindern). Nuclear Phys. 4, 39-43(1957) Aug.

An already known resonance is shown to consist of two separate resonances with $E_p = 504.5 \pm 0.2$ kev and $E_p = 506.5 \pm 0.2$ kev. Gamma transitions from the lower of the two levels proceed mostly to the ground state, while the upper level decays predominantly to the first excited state. (auth)

10757
SOFT γ-RAYS FROM THE CAPTURE OF THERMAL NEUTRONS BY NUCLEI. I. V. Estulin, L. F. Kalinki, and A. S. Melioransky (Moscow State Univ.). Nuclear Phys. 4, 91-111(1957) Aug.

A luminescent spectrometer was used to measure the energies and absolute intensities of the γ quanta emitted by Co^{59}, Rh^{103}, I^{127}, Sm^{149}, Au^{197}, and Hg^{199} nuclei following the capture of thermal neutrons. It is shown that the γ lines in the 50 to 500 kev energy range can be ascribed to transition from the lower excited states of the investigated nuclei. A description of the apparatus and method of measurement is presented. (auth)

10758
ANGULAR DISTRIBUTION OF 8.34 Mev GAMMA RADIATION FROM THE REACTION $N^{14}(p,\gamma)O^{15}$. S. Gorodetzky, A. Gallmann, M. Croissiaux, and R. Armbruster. Nuclear Phys. 4, 112-19(1957) Aug. (In French)

The resonance at 1060 kev in the reaction $N^{14}(p,\gamma)O^{15}$ has been investigated. The angular distribution of the 8.34-Mev radiation has been found to be $W(\theta) = 1 + 0.05\ P_2(\cos\theta)$. It is concluded that the angular momentum of the level at 8.34 Mev in O^{15} is $J = 3/2$. (auth)

10759
TIME REVERSAL AND POLARIZATION PHENOMENA IN $N + N \rightleftharpoons d + \pi$ REACTIONS. L. I. Lapidus (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Nuclear Phys. 4, 145-56(1957) Aug.

An analysis of polarization phenomena in $N + N \rightleftharpoons d + \pi$ reactions reveals how time-reversal invariance leads to connections between polarization phenomena in direct and inverse reactions. The Wolfenstein theorem has been extended to the case of a binary reaction. Expressions are given for various observable quantities in $N + N \rightleftharpoons d + \pi$ reactions for the case when only s, p, and d waves with $J \leq 2$ are considered as well as for the general case. (auth)

10760
ENERGY LEVELS OF Np^{237} POPULATED BY THE BETA DECAY OF U^{237}. J. O. Rasmussen, F. L. Canavan, and J. M. Hollander (Univ. of California, Berkeley). Phys. Rev. 107, 141-54(1957) July 1.

A spectroscopic investigation has been made of the radiations from U^{237} with magnetic 180° spectrographs and a double-focusing spectrometer, and with scintillation and coincidence spectrometers. Energy levels are identified at 0, 33.20, 59.57, 103.0, 267.5, 332.3, 368.5, and 370.9 kev, and spin and parity assignments are given for all the levels from the gamma-ray multipolarity and beta-decay information. Conversion-coefficient information is presented, and an anomaly in the electric-dipole conversion coefficients is discussed. A new rotational band with $K = 1/2$ is postulated, with base state at 332.3 kev. Correlations of the data with various aspects of the Bohr-Mottelson nuclear model are made, in the following categories: energy-level spacings and moments of inertia; gamma-ray relative intensities and the K-selection rules and branching-ratio rules; correlations of spins and parities with the Nilsson numbers (N,n_z,Λ) of these states; correlation of beta and gamma lifetimes with selection rules in the asymptotic quantum numbers. (auth)

10761
REACTION $F^{19}(d,p)F^{20}$ AND THE SPIN OF F^{20}. F. D. Seward, I. Slaus, and H. W. Fulbright (Univ. of Rochester, N. Y.). Phys. Rev. 107, 159-60(1957) July 1.

New measurements of the angular distribution of the protons from the reaction $F^{19}(d,p)F^{20}$ made with deuterons in the range $3.5 \leq E_d \leq 4.1$ Mev show that the reaction proceeds mainly by compound-nucleus formation, and that stripping makes at most a small contribution. It follows that the interpretation of the results of an earlier experiment in terms of stripping is unjustified, hence that the spin of F^{20} is not necessarily 1. At all energies the angular distribution of protons leaving F^{20} in its first excited state shows a clear stripping curve corresponding to $l_n = 2$. (auth)

10762
INTENSITIES OF X-RAYS AND γ RAYS IN Am^{241} ALPHA DECAY. L. B. Magnusson (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 161-70(1957) July 1.

Electromagnetic radiation intensities from levels of Np^{237} were remeasured with NaI scintillation detectors and an argon proportional chamber. By absolute and coincidence counting the photon intensities per alpha particle are 0.376, 0.025, 0.00073, and 0.359 for the L x-rays and the 26.4-, 43.4-, and 59.6-kev gamma rays, respectively. Gamma rays with 99- and 103-kev energy were found by $\alpha-\gamma$ coincidence. The 99-kev γ ray is emitted from the 159-kev level with an intensity of 2.3×10^{-4}. The 103-kev ray, of intensity 1.9×10^{-4} per alpha particle, is a de-excitation of the 103-kev level. The intensity of L x-rays from levels above 59.6 kev is 0.064. Coincidence intensities of 26-kev γ rays with L x-rays from conversion of the 33.2-kev γ ray and of L x-rays from these transitions are 0.01 and 0.031 per alpha particle, respectively. (auth)

10763
ANGULAR DISTRIBUTION OF PROTONS FROM THE $Ca^{42}(d,p)Ca^{43}$ REACTION. C. K. Bockelman, C. M. Braams, C. P. Browne, W. W. Buechner, R. R. Sharp, and A. Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 176-81(1957) July 1.

The broad-range magnetic spectrograph was employed in conjunction with a 7-Mev deuteron beam from the MIT-ONR electrostatic generator to obtain angular distributions and relative cross sections for the twelve most intense proton groups corresponding to Ca^{43} levels up to 3.6-Mev excitation. The angular momenta of the captured neutrons were determined by application of deuteron stripping theory. (auth)

10764
ANGULAR DISTRIBUTION OF PROTONS FROM THE $Ca^{44}(d,p)Ca^{45}$ REACTION. W. R. Cobb and D. B. Guthe (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 181-5(1957) July 1.

The broad-range magnetic spectrograph has been used to study proton groups produced from thin Ca^{44} targets bombarded by 7-Mev deuterons. The angular distributions and relative intensities of groups corresponding to levels in Ca^{45} were measured. Stripping theory was employed to determine the angular momenta of the captured neutrons. (auth)

10765

ANGULAR DISTRIBUTION OF PROTONS AND TRITONS FROM THE REACTIONS $Be^9(d,p)Be^{10}$ AND $Be^9(d,t)Be^8$ AT LOW BOMBARDING ENERGIES. R. K. Smither (Yale Univ., New Haven, Conn.). Phys. Rev. 107, 196-200(1957) July 1.

The angular distributions of protons and tritons from the nuclear reactions $Be^9(d,p)Be^{10}$ and $Be^9(d,t)Be^8$ were measured for incident deuteron energies of 100, 170, and 200 kev. A nuclear plate camera was used in which the relative cross sections for protons and tritons could be measured at 36 different angles between 15 and 165°. The angular distributions of protons exhibit a minimum yield in the forward direction which increases to a maximum in the backward direction. The angular distribution of tritons also show a minimum cross section in the forward direction, but the maximum occurs between 120 and 150° and is quite broad. The maximum in the triton cross section increases in value relative to the cross section at 90° and moves toward the backward direction as the incident deuteron energy is decreased. This makes the angular distributions of protons and tritons much more alike in the case of 100-kev incident deuteron energy than for the 200-kev case. The angular distributions were analyzed in terms of the first three Legendre polynomials. Their possible relation to compound nucleus formation is discussed. The total cross section for the $Be^9(d,p)Be^{10}$ reaction was found to be 4.9 ± 2, 16.0 ± 4, and 37.0 ± 10 μb for the incident deuteron energies of 100, 170, and 200 kev, respectively. The ratio of the total cross section for tritons to the total cross section for protons was found to be 1.11, 0.97, and 0.91 for deuteron energies of 100, 170, and 200 kev, respectively. (auth)

10766

REACTIONS $O^{16}(d,p)$, (d,α), AND (d,d) IN THE ENERGY RANGE 3.4 TO 4.2 Mev. E. Baumgartner and H. W. Fulbright (Univ. of Rochester, N. Y.). Phys. Rev. 107, 219-22(1957) July 1.

Cross sections and angular distributions are given for the (d,p), (d,α), and (d,d) reactions on O^{16} in the deuteron energy range 3.4 to 4.2 Mev. (auth)

PARTICLE ACCELERATORS

10767 MURA-318

Midwestern Universities Research Assn., Madison, Wisc.

ON THE TWO-BEAM FFAG ACCELERATOR. Tihiro Ohkawa. July 5, 1957. 35p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

Analytical expressions for the orbits and the linear betatron oscillations of the two-beam FFAG accelerator are given and compared with the results obtained by the digital computer. Typical design parameters are discussed. (auth)

10768

THE LARGE LINEAR ELECTRON ACCELERATOR AT ORSAY. H. Halban. Industries Atomiques No. 7 and 8, 31(1957) June-July. (In French)

The large linear accelerator under construction at Orsay, France, is described, and the construction progress reported. (T.R.H.)

10769

HIGH ENERGY PARTICLES. A. K. Burtsev and M. I. Fradkin. (Lebedev Moscow Inst. of Physics). Priroda, 46, No. 6, 43-9(1957) June. (In Russian)

Report is given of the All-Union Conference on high-energy physics which took place in Moscow, 1956. Interactions of elementary particles were discussed during the first two sessions, while the third session was devoted to the problems, improvements, and building programs of particle accelerators. (R.V.J.)

RADIATION ABSORPTION AND SCATTERING

10770 CU-165

Columbia Univ., New York.

THE RESONANCE SCATTERING OF SLOW NEUTRONS FROM GOLD AND INDIUM (thesis). James A. Moore. June 20, 1957. 120p. Contract AT-30-1-GEN-72. $8.30 (ph OTS); $6.30(mf OTS).

Using a crystal spectrometer as a mono-energetic source, the scattering of slow neutrons by Au and In was observed with targets which were thick for the incident beam but thin for the emergent scattered particles (thick-thin method). The ratio σ_s/σ_t was evaluated as a function of the scattering rates. Gold was studied in the range 1 to 15 ev and In from 0.3 to 11 ev. The transmission of In was also measured over the 0.3 to 11 ev range to supplement existing transmission studies. The value of σ_s was computed from the σ_τ (transmission), and σ_s/σ_t (scattering). Both the σ_s/σ_t ratio and σ_s were analyzed to obtain Breit-Wigner parameters. The scattering cross sections were consistent with the Breit-Wigner equation, and the parameters obtained were consistent with those obtained using transmission values alone. In addition, the spins of the compound nuclear states which required both transmission and scattering measurements were evaluated. For the nuclear state in Au^{198} at 4.906 ev, the g value was 5/8, and for In^{116} at 1.456 it was 11/20. (auth)

10771 NRL-4962

Naval Research Lab., Washington, D. C.

SOME APPLICATIONS OF SCATTERING THEORY. A. H. Aitken. May 27, 1957. 40p.

The equations for the scattering of a particle by a system possessing internal degrees of freedom are set up and applications are made to nuclear and magnetic scattering of low energy neutrons. (auth)

10772 NRL-4937

Naval Research Lab., Washington, D. C.

INELASTIC SCATTERING OF 2.6-MEV NEUTRONS FROM Fe^{54}, Fe^{56}, Fe^{57}, W^{182}, AND W^{184}. P. Shapiro and R. W. Higgs. Apr. 10, 1957. 21p. Projects NR 540-000 and NR 540-007.

Gamma rays following inelastic scattering of 2.6-Mev d-d neutrons from isotopically enriched samples of Fe^{54}, Fe^{57}, W^{182}, W^{184}, and from normal iron and tungsten have been observed in a NaI scintillation spectrometer using the He^3 coincidence technique. The observed gamma rays are listed and are assigned to particular isotopes of the elements studied. Decay schemes are proposed for Fe^{54}, Fe^{56}, and Fe^{57}. Determination of the photopeak efficiency of a NaI summing spectrometer is discussed. (auth)

10773

OPTICAL MODEL ANALYSIS OF PROTON SCATTERING ON SOME LIGHT NUCLEI. Anwar Hossain and Syeduzzaman (Dacca Univ., Pakistan). Nuclear Phys. 4, 88-90(1957) Aug.

The scattering of 9.5-Mev protons by He^4, N^{14}, and A^{40} was investigated using the formula $R = (0.6 + 1.26A^{1/3}) \times 10^{-13}$ cm for the nuclear radius. (L.T.W.)

10774
SOFT X-RAY ABSORPTION BY THIN FILMS OF CHROMIUM. Bipin K. Agarwal and M. Parker Givens (Univ. of Rochester, N. Y.). Phys. Rev. 107, 62-4(1957) July 1.

The absorption of soft x rays by Cr has been measured in the spectral region between 250 and 300 A. The observed absorption band is interpreted as a combination of M_3 and M_2 bands in the ratio of 3:2 and separated by 1.5 ev. (auth)

10775
EXCITATION OF NITROGEN BY PROTONS OF A FEW kev ENERGY. N. P. Carleton (Harvard Univ., Cambridge, Mass.). Phys. Rev. 107, 110-13(1957) July 1.

To aid in interpreting auroral spectra, the excitation of nitrogen by protons of a few kev energy was investigated. The dependence of the intensity of the various spectral features on the proton current and gas pressure gives evidence about the excitation mechanisms. The conclusions are that the first negative and Meinel systems of N_2^+ are excited through charge exchange, that the first positive systems of N_2 is excited, not by proton impact, but by the impact of fast neutral atoms, that allowed N_1 lines are excited by a single process involving dissociation and excitation, and that the Balmer lines result from charge capture directly into an excited state. As compared with excitation by electron impact, vibration is enhanced in the upper level of the first positive system, but rotational temperatures derived from the first negative system of N_2 agree with the gas temperature. (auth)

10776
POLARIZATION OF BREMSSTRAHLUNG FROM MONOCRYSTALLINE TARGETS. H. Überall (Univ. of Liverpool, Eng.). Phys. Rev. 107, 223-7(1957) July 1.

The polarization of bremsstrahlung of high-energy electrons in a monocrystalline target was investigated. It is shown that, owing to interference effects, the polarization is considerably increased above its value when amorphous targets are used (by a factor of 1.5 for typical cases); moreover, the total emitted bremsstrahlung cone has an over-all net polarization with respect to the plane formed by the direction of incidence and the crystal axis. This latter fact provides a means of producing partially polarized radiation with an intensity sufficient for performing significant high-energy polarization experiments. The dependence on the emission angle of the interference radiation is also calculated. The influence of elastic scattering of electrons is estimated. (auth)

10777
CIRCULAR POLARIZATION OF INNER BREMSSTRAHLUNG. G. W. Ford (Univ. of Notre Dame, Ind.). Phys. Rev. 107, 321-2(1957) July 1.

It is pointed out that by measuring the circular polarization of the inner bremsstrahlung photons accompanying beta decay, the same information can be gained as in a measurement of the longitudinal polarization of the electrons. (M.H.R.)

10778
CIRCULAR POLARIZATION OF INTERNAL BREMSSTRAHLUNG. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 107, 330-1(1957) July 1.

The internal bremsstrahlung associated with K capture was examined for properties which are consequences of parity nonconservation, with particular attention being given to the two-component neutrino theory. (M.H.R.)

RADIATION EFFECTS

10779 AECU-3518
Illinois. Univ., Urbana.
X-RAY STUDY OF DEUTERON IRRADIATED COPPER NEAR 10°K (thesis). Technical Report No. 10. Ralph O. Simmons. Apr. 1957. 57p. Contract AT(11-1)-182. $9.30(ph OTS); $3.60(mf OTS).

Results of precise lattice expansion measurements on high-purity Cu held near 10°K during bombardment with deuterons are given. The magnitude of the relative expansion was found to be $4.1 \pm 0.2 \times 10^{-21}$ per incident 7 Mev deuteron/cm^2. Thermal recovery of the expansion temperature range 15 to 302°K is strikingly similar to the recovery of electrical resistivity changes produced by deuteron irradiation. About 55% of the recovery occurs in the range below 42°K, and the recovery is essentially complete at 302°K. (W.L.H.)

10780 AERE-R/M-118
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE BUILD-UP OF PLUTONIUM ISOTOPES BY IRRADIATION. W. G. Davey. Mar. 1957. 13p. (LMFS/P-12).

The characteristics of the mixture of Pu isotopes formed after long neutron irradiation of Pu^{239} are estimated. The effects of various neutron spectra are considered, and some general conclusions are drawn. (auth)

10781 NARF-57-28T
Convair, Forth Worth, Tex.
METHODS AND PROCEDURES FOR RADIATION DAMAGE ANALYSIS. A Supplement to the Radiation Effects Handbook for Aircraft Designers. W. L. Fink. June 27, 1957. 103p. Project 6(1-9964). Contract AF33(600)-32054. (MR N-169).

Supplement to NARF-54-1T.

Methods are presented for normalizing the flux measurements from different reactor facilities to a common unit. The unit selected is energy absorption in the test specimen. This requires a microscopic determination of energy loss by gamma rays and neutrons. The determination of functional damage thresholds for material application is discussed. These thresholds are based on the energy absorbed by the material. Experimental data are used to relate the change of physical properties under an irradiation environment. A statistical method is presented to aid in the analysis of experimental data. (auth)

10782
DENSITY CHANGE OF SODIUM CHLORIDE PRODUCED BY PROTON IRRADIATION AND ITS THERMAL ANNEALING. Koichi Kobayashi (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 107, 41-3(1957) July 1.

The density change of NaCl crystals upon irradiation with 350 Mev protons with a total flux of 1×10^{16} protons/cm^2 has been measured and found to be -8.3×10^{-4} g/cm^3. The number of negative-ion vacancies calculated from this density change is of the same order as the number of F centers estimated from the stored-energy measurements. The recovery of the density change with thermal annealing has also been studied. A relation between the behavior of the density change and of color centers is discussed. (auth)

RADIOACTIVITY

10783
METHOD FOR TESTING TIME-REVERSAL INVARIANCE IN BETA DECAY. M. Morita and R. Saito Morita (Columbia Univ., New York). Phys. Rev. 107, 139-40(1957) July 1.

One of the possible tests of time-reversal invariance in weak interactions is the electron-neutrino angular correlation, for which no polarized nuclei and no measurements of the polarization of emitted electrons are required. If the electron-neutrino angular correlation function, e.g., $1 + (p/3W)f(g)\cos\theta$ (for $\Delta J = \pm 1$ transitions) has p and/or Z dependences in the measurements of f(g), invariance

under time reversal T is not conserved. Conversely, if invariance under T holds, there are no p and Z dependences of f(g). In experiments, it is advisable to compare the f(g)'s for electron and positron decays. Furthermore, the experiment will be another possible test of charge-conjugation invariance if time-reversal invariance does not hold. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

10784
STUDIES ON THE LONG-LIVED ACTIVITIES OF EUROPIUM. S. K. Bhattacherjee and Shree Raman (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 4, 44-60(1957) Aug.

Long-lived activities of europium, Eu^{152} (13y) and Eu^{154} (16y), were studied by a coincidence scintillation spectrometer. The measured gamma-ray energies (kev) and their relative intensities are 80 ± 4(0.52), 124 ± 4(1.85), 244 ± 7(1.00), 340 ± 10(2.16), 410 ± 20(0.15), 710 ± 25(0.34), 770 ± 22(1.27), 870 ± 30(0.57), 970 ± 20(1.93), 1090 ± 21 (1.88), 1260 ± 40(0.5), 1410 ± 25(1.99). X-gamma and gamma-gamma coincidence experiments were carried out by employing pulse-height selection; beta-gamma coincidence were recorded by using an anthracene crystal spectrometer. Decay schemes for the two isotopes are proposed on the basis of our experimental results. The first two excited states of Sm^{152} reached by the capture decay of Eu^{152} at 121 and 365 kev are identified as rotational levels belonging to the ground state configuration; higher excited states in Sm^{152} (N = 90) were also reached by capture decay of Eu^{152}. On the other hand the first two excited states of Gd^{152} (N = 88) reached by β decay of Eu^{152} at 340 and 750 kev are probably vibrational in origin. The ground state spin of Eu^{152} is assigned as 4. The newly found gamma ray of energy 80 kev is identified as the one arising from de-excitation of the first rotational level of Sm^{154}, a state which has also been observed in Coulomb excitation experiments. Decay schemes are discussed in the light of the unified nuclear model. (auth)

10785
POSSIBLE VIBRATIONAL LEVELS IN Dy^{160}. Ove Nathan (Univ. of Copenhagen). Nuclear Phys. 4, 125-44(1957) Aug.

The radiations of Tb^{160} have been studied by means of magnetic and scintillation spectrometers and various coincidence techniques. A decay scheme has been proposed which includes the following excited states in Dy^{160}: 87 kev (2+), 283 kev (4+), 964 kev (2+), 1047 kev (3+), 1262 kev (2–), and 1359 kev (3–). The level scheme is discussed in the light of the unified model, and it is suggested that the states at 964 kev and 1047 kev may possibly belong to a rotational band associated with electric quadrupole vibrations (gamma vibrations) and that the states at 1262 kev and 1359 kev similarly may belong to a rotational band associated with electric octupole vibrations. (auth)

SPECTROSCOPY

10786 AERE-C/R-2152
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN OF A 21-FOOT SPECTROGRAPH USING A PLANE GRATING. PART I. THE PLANE GRATING IN CONVERGENT LIGHT. E. W. T. Richards, A. R. Thomas, and W. Weinstein. Jan. 7, 1957. 12p.

10787 UCRL-3492
California. Univ., Berkeley, Radiation Lab.
A COAXIAL STATIC-ELECTROMAGNETIC VELOCITY SPECTROMETER FOR HIGH ENERGY PARTICLES. Joseph J. Murray. May 7, 1957. 15p. Contract W-7405-eng-48. $0.20(OTS).

An apparatus is described in which crossed E and H fields will be used to separate high-energy charged particles of different masses. It is shown that use of coaxial geometry is expected to effect satisfactory separation within a considerably shorter system than would be possible in a parallel-plate system with a comparable separation criterion. A summary is given of the operational characteristics of a spectrometer now under construction. (auth)

10788
HETERODYNE DETECTION OF FREE PRECESSION IN NUCLEAR MAGNETIC RESONANCE. Henri Benoit and Robert Klein. Compt. rend. 245, 155-7(1957) July 8. (In French)

The apparatus used included a low impedance bridge and a quartz crystal oscillator (fixed frequency of 8.05). A receptor filter amplified and detected the signal from the bridge. The resonance of protons in the water of $Fe(NO_3)_3$ solutions was studied. The rotating field strength was 6×10^{-2} gauss. (T.R.H.)

10789
IMPROVED METHODS OF X-RAY SPECTROSCOPY. K. I. Narbutt. Vestnik Akad. Nauk S.S.S.R. 27, 108-10(1957) May. (In Russian)

THEORETICAL PHYSICS

10790
ENERGY LEVEL SHIFTS OF SPIN-½ PARTICLES IN A COULOMB FIELD. G. A. Zaitsev. Doklady Akad. Nauk S.S.S.R. 114, 61-3(1957) May 1. (In Russian)

Energy levels were found for particles with spin ½ and negative charge (μ meson or electron) in the electromagnetic field. The basic equation for particles with spin ½ was applied in the calculation. (R.V.J.)

10791
ON THE PERMISSIBLE TRANSFORMATIONS OF EQUATIONS FOR PARTICLES WITH HIGHER SPINS. E. E. Fradkin and S. V. Izmailov (Gertsen Leningrad State Pedagogical Inst.). Doklady Akad. Nauk S.S.S.R. 114, 277-80(1957) May 11. (In Russian)

Possible linear transformations of the wave function of the type $\psi(x_0, x_1, x_2, x_3) = S\,\psi(x_0, x_1, x_2, x_3)$ have been studied, and aspects of matrix S for permissible transformations have been determined. The transformation of the equation for a particle with spin ½ has been analyzed. (R.V.J.)

10792
TEMPERATURE DEPENDENCE OF DISTRIBUTION FUNCTIONS IN QUANTUM STATISTICAL MECHANICS. Irwin Oppenheim (National Bureau of Standards, Washington) and John Ross (Brown Univ., Providence, R. I.). Phys. Rev. 107, 28-32(1957) July 1.

The Bloch equation is utilized to derive an integro-differential equation for the temperature dependence of the Wigner distribution function of a canonical ensemble. This equation is solved by two methods; one yields a power series in Planck's constant and the other a power series in the potential energy of the system. Transformation functions for the density matrix and the Wigner function are discussed and their possible application in the treatment of systems obeying Fermi-Dirac or Bose-Einstein statistics is investigated. (auth)

10793
DEPENDENCE OF THE AVERAGE CHARGE OF AN ION ON THE DENSITY OF THE SURROUNDING MEDIUM.

Jacob Neufeld (Oak Ridge National Lab., Tenn.) and W. S. Snyder (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 96-102(1957) July 1.

The experiments of Lassen revealed the existence of two density effects expressing a dependence of the average charge of a moving heavy ion on the density of the surrounding medium. These are as follows: the pressure effect characterizing gases and the state of condensation effect characterizing solids and liquids. According to Bohr and Lindhard, these two effects are phenomenologically analogous since they involve a relationship between the times separating successive collisions of the moving ion and the times required for the excited orbital electrons to readjust themselves either by radiation or by redistribution of their excitation energy. It is conjectured that the phenomenological similarity may not be complete since in determining the state of condensation effect one also has to take into account the effect of a polarizing field due to the reaction of the perturbed medium on the moving ion. This field causes spontaneous emission of electrons carried by the ion, thus increasing the effective charge of the ion. A relationship is established between various values of the polarizing field and the corresponding average charge of an incident heavy ion in which the orbital electrons are continually maintained in an excited state due to the recurrent collisions with the atoms in the surrounding medium. The value of the polarizing field is determined for a particular case of a heavy fission fragment in gold and by applying this value to the above relationship it is shown that the contribution of the autoionization is substantial. Therefore, this contribution should be taken into account in determining the cause of the state of condensation effect. The autoionization is due to distant collisions, i.e., to the portion of the medium relatively far removed from the particle track, whereas the effect of Bohr and Lindhard is due to close collisions with atoms adjacent to the track. (auth)

10794

MANY-BODY PERTURBATION THEORY. W. Tobocman (Univ. of Birmingham, Eng.). Phys. Rev. 107, 203-8(1957) July 1.

The usual perturbation treatment of the many-body problem is modified by eliminating the two-body interaction and introducing in its place a t matrix. The Watson, Brueckner, and Bethe (W.B.B.) treatment of the many-body problem is shown to be a special case of the modified perturbation treatment. The modified perturbation treatment involves no assumption except that of supposing the convergence of the perturbation expansion. Thus to each order in the expansion the results must be meaningful and no unphysical unlinked cluster terms can appear. Within the framework of the modified perturbation treatment the concepts of the Pauli principle for intermediate states and the self-consistent choice of the comparison potential are interpreted which play such an important role in the W.B.B. treatment. This work is similar to that of J. Goldstone in that the W.B.B. treatment is related to a perturbation treatment of the many-body problem. However, the usual time-independent perturbation theory is used instead of the time-dependent one. The time-independent approach permits a direct comparison with the W.B.B. treatment and facilitates discussion of the Pauli principle for intermediate states and of the self-consistent potential. (auth)

10795

WEAK DECAY INTERACTIONS. F. Coester (State Univ. of Iowa, Iowa City). Phys. Rev. 107, 299-300(1957) July 1.

The time-reversal properties of a weak-decay Hamiltonian affect the possible observation of interferences. This effect is discussed and a general proof for a theorem by Lee, Oehme, and Yang is given. (auth)

10796

REFORMULATION OF THE MAJORANA THEORY OF THE NEUTRINO. K. M. Case (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 107, 307-16(1957) July 1.

The Majorana theory for a particle with mass is reformulated in terms of a two-component field. In this form it is seen that the theory goes over continuously to the Weyl-type two-component equation as the mass tends to zero. The asymmetries obtained in β and μ decay experiments are shown to imply only that the neutrino mass is small—not that it is zero. Also the asymmetries are shown to be no more implied by the use of a two-component theory than by the use of a four-component one. Two-component theories do imply certain relations between mass, parity nonconservation, and double β decay. That there are asymmetries is due to the fact that the interactions necessary to describe the physical world are not reflection-invariant. (auth)

TRACER APPLICATIONS

10797

METHOD OF MEASUREMENT SUITABLE FOR RADIOCARBON 14. Sonia Apelgot. J. phys. radium 18, Suppl., 78A-89A(1957) July. (In French)

The experimental difficulties encountered in labeling molecules of biological interest with a high specific activity, when radiocarbon 14 is the tracer, are reviewed. Two measuring methods are given: the silver-sulfonic-chromic reaction which transforms any biological or organic sample (liquid or solid) into barium carbonate, and the radioactivity measurement by means of a counter with carbon dioxide. With the counter described, which has a volume of 200 cm^3, it is possible to determine the radioactivity of an organ weighing 380 mg (weight of fresh tissue) with only one measurement. To emphasize the improvement obtained, two parallel biological experiments are described: in the first one, the usual Geiger-Mueller counter is used and in the second the carbon dioxide counter. (auth)

URANIUM AND URANIUM COMPOUNDS

10798 HW-50363

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A GENERAL METHOD OF ANALYSIS OF PRIMARY CREEP DATA. (Including Analysis of Uranium Creep Data). K. R. Merckx. May 1, 1957. 21p. Contract W-31-109-Eng-52. $0.20(OTS).

The experimental results of creep tests run on alpha uranium are analyzed and formulated into a mathematical model for material behavior. In general, the material model has the following form: $\dot{e}_i = \dot{s}_i + fs_i$, where $f = E^{-m(T)} \exp[k(T) + d(T)\,S]$. The analysis of uranium creep data from 100 to 600°C gave the following results: $m = 8.00 - 0.427\,\text{sign}(T-300)\,|T-300|^{\frac{1}{2}}$, $d = 266 - 0.625\,T + 6.25 \times 10^{-4}\,T^2$, and $k = 82.4 - (8.45 \times 10^4/T + 273) + (1.19 \times 10^7/(T + 273)^2$, with these units: E [%], time [hr], T [C], S [%]. The alterations of this material law which facilitated thermal stress calculations are included. (auth)

10799

ISOMERIC STATE OF URANIUM-235. Frank Asaro and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 107, 318-19(1957) July 1.

An isomeric state decaying by emission of very soft

electrons was found by collecting recoils from the α decay of Pu^{239} and counting the U^{235m} in a windowless proportional counter. Results indicate a half life of 26.5 ± 0.2 min and electron energy <1 kev. (M.H.R.)

10800

27-MINUTE ISOMER OF U^{235}. J. R. Huizenga, C. L. Rao, and D. W. Engelkemeir (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 319-20(1957) July 1.

Low-energy excited states of U^{235} and sample separation methods are given. Least-squares analyses of decay curves give a half life of 26.6 ± 0.3 min for the U^{235} isomer. Absorption experiments with U^{235m} samples prepared by a recoil technique on thin films serve to show that the electrons are of very low energy, $\lesssim$2 kev. (M.H.R.)

10801

RESONANCE FISSION OF U^{235}. C. I. Browne (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 325(1957) July 1.

Fission-product activity ratios produced by thermal-neutron fission of U^{235} are compared with the ratios produced in the neutron fission of U^{235} in a slowing down, or dE/E, spectrum. Ratios are compared to those of Mo^{98}. (M.H.R.)

10802

THE PLASTIC DEFORMATION OF URANIUM ON THERMAL CYCLING. H. H. Chiswik (Argonne National Lab., Lemont, Ill.). Trans. Am. Soc. Metals 49, 622-54(1957).

The growth of alpha rolled uranium rods on thermal cycling has been shown to depend on both preferred orientation and grain size. Preferred orientation appears to be a necessary condition for growth to occur; the extent of the growth depends upon the sharpness of texture developed and the grain size. The highest growth rates occur in specimens with highly developed textures coupled with small grain sizes. The growth rates increase with cycling level, particularly in specimens of large grain size. Beta treatment reduces the growth considerably but does not eliminate it completely. The growth increases progressively with increases of reduction of area following beta treatment. Room temperature thermal expansion coefficients were found to be good qualitative guides in evaluating the comparative growth behavior: material highly anisotropic in expansion grows more than material of lower anisotropy, provided their grain sizes are the same. (auth)